UNITED STATES DEPARTMENT OF AGRICULTURE

AGRICULTURAL RESEARCH SERVICE

EXPLANATORY NOTES

Fiscal Year

1978

PRESIDENT PROPOSES INCREASED BASIC FOOD PRODUCTION RESEARCH

WASHINGTON, Jan. 17--Basic research related to food production problems will receive a significant boost if a proposal in the President's fiscal year 1978 budget is approved. The proposal is for a competitive research grant program with a 1978 appropriation of $27.6 million to the U.S. Department of Agriculture, open to all qualified researchers in the U.S.

The program has been advanced because of the potential seriousness of the world food situation and the need for energy conservation. Agricultural experts point out that mission-oriented basic research related to food production has been neglected over recent years, and therefore new basic knowledge needed to bring significant plant and animal production increases is inadequate. This support program for basic food production research is intended to help correct that situation.

Four areas have been chosen for intensive investigation initially. These four have been identified by a number of recent studies and reports as offering the greatest potential for advancing food production. They are photosynthetic efficiency, biological nitrogen fixation, cellular and genetic engineering of plants, and plant protection studies focusing on biological stresses on plants.

Photosynthesis is part of a basic process by which the energy of the sun is used by the plant to produce food and other products. One area of needed research is to understand how to make the plant more efficient in using the sun's energy. Better knowledge of how plants turn the products of photosynthesis into nutritional food products is another research objective in this area.

Biological nitrogen fixation is the process whereby plants are aided by certain bacteria that convert nitrogen from the air into forms plants can use.

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Some plants, such as legumes, are much better at this than are others. Nitrogen is essential to crop production. But sources of commercial nitrogen fertilizer are becoming more costly and some unavailable, and require large amounts of fossil fuel in their production. In the future we will have to depend more on the plants themselves to provide their own nitrogen. Thus this research is needed to find ways that the biological processes involved in nitrogen fixation in grasses and legumes can be modified to reduce genetic, physiological and environmental barriers to crops providing naturally more of the nitrogen they need.

Research in cellular and genetic manipulation of plants is vital to find new approaches to transfer desirable traits from one species of plant to another. Some plants or strains, including some distantly related groups, that are not in themselves useful to man do have characteristics such as superior pest, drought, or heat resistance, nitrogen-fixation capacity, or nutritional qualities that would improve other more useful plants. Conventional plant breeding procedures have been unsuccessful in overcoming certain biological barriers in genetic manipulation that this research may solve.

Finding ways of helping plants cope with biological stresses that reduce their vitality and productivity is important to total food production. This research would focus on pest insects, nematodes, weeds, fungi, bacteria, and viruses. Included would be research on plant susceptibility and resistance, on the dynamics of particular host-parasite systems.

Although details of the grant program have not yet been worked out, some guidelines have been: First, the grant competition will be open to scientists in the U.S. with expertise in the specified areas of emphasis, and who have access to necessary institutional facilities and resources to conduct the research.

Second, the program will be guided by a policy advisory group made up of representatives of the USDA, universities engaged in research, the National Academy of Sciences, HEW, the National Science Foundation, and the private research sector.

Third, all proposals would be funded based on peer review panel ratings. Fourth, an Office of Mission-Oriented Basic Research Grants would be established in the USDA's Cooperative State Research Service to coordinate the program.

Fifth, grants probably would be made for a three-to-five-year period. The funds are to support new research and to speed the progress of especially promising research.

If the program is approved by the Congress, USDA plans to get the process underway as rapidly as possible. It also plans followup throughout the life of the program--such as workshops in the various areas of inquiry that will give grant recipients the chance to interact with each other and with other scientists in their area of interest. The program will be rigorously evaluated, and monitored, USDA officials say.

The USDA's two agencies most closely associated with food production research--the Cooperative State Research Service and the Agricultural Research Service--are responsible for developing detailed plans for how the program would operate. Detailed proposal procedures will not be announced until the appropriations bill has been signed.

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U.S. DEPARTMENT OF AGRICULTURE

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TO Dr. Cooper

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REMARKS Attached is a revised fact sheet on the Competitive Grant Program. This replaces the one sent to you earlier. The only change is the last paragraph.

(att. 1 Explanatory letter)

Make copies: BRF 1
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FROM Eunice Hawker
Acting Director
ARS-BFD

GPO : 1964 OF—742-059

FORM AD-514 (8-64)

January 17, 1977
CSRS-USDA

Fact Sheet

COMPETITIVE GRANT PROGRAM

FOR BASIC RESEARCH IN FOOD PRODUCTION

The President's budget message to the Congress for Fiscal Year 1978 provides for a competitive grant program to support expanded basic research related to food production. The program would be operated by the U.S. Department of Agriculture. If approved by the Congress, the program would give some much needed support and impetus to this area of research.

While all details of the proposed program have not been worked out yet, the information that follows will lay out the general framework.

Size of the program. The FY 1978 budget proposal is for $27.6 million.

Areas to be researched There are four: Photosynthetic efficiency, biological nitrogen fixation, cellular and genetic engineering of plants, and plant protection studies focusing on biological stresses placed on plants by such pests as insects, weeds, nematodes, viruses, bacteria, and fungi. Other areas may be added as the program develops.

Why these four research areas? There are many very important problem areas where more fundamental information is needed if needed advances are to be made. Among others, these areas include how such environmental adversities as drought, heat, and cold affect crop plants; reproductive problems in farm animals; physical and chemical characteristics of soils and their capabilities as disposal sites for wastes; and human nutrition and food safety. But because of necessary budget prudence, a few highly important research categories were selected with request for sufficient funds to mount a significant research thrust in those categories. These categories also provide opportunity to attract important scientific talent outside of traditional agricultural research circles to contribute usefully and significantly to advances in food production.

The four areas selected for initial support in crop productivity are closely interrelated. Crop yield depends on plant photosynthetic efficiency, the availability of enough nitrogen, the recombination of genetic materials to provide both photosynthate and nitrogen, and the prevention of losses from pests. All the basic studies will relate to different aspects of the fundamental processes of plants, and factors affecting those processes.

The four research areas are among the high priority areas recommended by a number of intensive efforts during the

past year or so to develop the priorities, estimate resource requirements, and plan the appropriate organization for needed basic research related to food production. Among these were the Working Conference on Research to Meet U.S. and World Food Needs sponsored by the Agricultural Research Policy Advisory Committee (ARPAC), the World Food and Nutrition Study of the National Academy of Sciences, the International Conference on Crop Productivity - Research Imperatives, the hearings by two subcommittees of the House of Representatives Committee on Science and Technology, the study on U.S. Food Research by ARPAC, and the Assessment of Alternatives for Supporting High Priority Basic Research to Enhance Food Production by the Advisory Panel for the Office of Technology Assessment.

Who will handle the grant program?

The money would be appropriated to the U.S. Department of Agriculture. The Cooperative State Research Service in the USDA would set up an Office of Mission-Oriented Basic Research Grants under a Program Director. Several Grant Managers would then be responsible to the Director for each of the major research categories. Peer review panels would be used to evaluate proposals.

Why USDA?

Actually, USDA has been engaged in granting activities for a long time. Food and fiber production is the primary responsibility of the USDA. In line with that responsibility, USDA is the lead agency of the Federal government for food production research. So placing the new grant program there makes sense.

Purposes of the program.

First is to get the fund of basic knowledge built up that is needed for major advances and breakthroughs in food production. Second, it is designed to bring new people and organizations into these areas of research, under USDA's leadership. The program is not intended to replace or substitute for current, ongoing base programs in USDA and the State agricultural experiment stations. Funds will be used to support new research and accelerate existing highly promising research.

Who may apply for grants?

Researchers in State agricultural experiment stations, other researchers in both State and private universities, people in USDA and other Federal agencies, and those affiliated with private research organizations--all may be considered, providing they can demonstrate their competence to do the research and their access to needed facilities and resources.

The program is <u>not</u> intended to initiate new programs or to fund facilities construction.

Oversight for the program

A policy group of representatives of the USDA, universities engaged in research, the National Academy of Sciences, the HEW Department, the National Science Foundation, and the private research sector will give oversight to the program.

How this program relates to other Federally funded grant programs

This program is highly mission-oriented, aimed at both intermediate and long-range increases in food production. Research results will be monitored and evaluated during and after the research--for applicability of the findings, and for value in relation to the objectives of the program. Also, program policies will be set and periodically reviewed by a group representing the broad research community, as outlined above. Extensive conferences have been held between representatives of the USDA and officials of NIH, NSF, and the new Office of Science and Technology Policy to solicit advice based on their experience with grant programs like this, and to insure that this program would be complementary to related research support activities in NSF. Peer review panels, grant managers, and proposal mechanisms will be generally similar to those used by NSF and NIH.

This program will be coordinated with other Federally funded programs that impinge upon the quality of the environment, energy use, and human health considerations, as well as phases of agricultural science.

Who to contact for further information

If and when the program becomes a reality, all means will be taken to inform the research community of the details. Detailed proposal procedures will not be announced until the appropriations bill clears Congress and is signed by the President. This fact sheet contains essentially what is known about the proposal at this time. Administrators for the two USDA units that will eventually be working out details of the program are: Richard J. Aldrich, Cooperative State Research Service, and T. W. Edminster, Agricultural Research Service.

ATTACHMENT

COOPERATIVE STATE RESEARCH SERVICE

	Appropriation Act, 1977	Executive Budget, 1978	Change from 1977
Hatch Act			
Payments to States	$94,801,701	$102,651,911	+$7,850,210
3% set-aside for Federal administration	2,695,299	2,938,089	+242,790
Subtotal, Hatch Act	97,497,000	105,590,000	+8,093,000
Penalty mail	476,000	476,000	- -
Total, Hatch Act	97,973,000	106,066,000	+8,093,000
McIntire-Stennis Cooperative Forestry	8,212,000	8,212,000	- -
P. L. 89-106 Special Grants:			
1890 Institutions and Tuskegee Institute	13,352,000	14,153,000	+801,000
USDA Programs	4,500,000	5,060,000	+560,000
Food and agriculture policies	(150,000)	(150,000)	- -
Beef and pork production research	(400,000)	- -	(-400,000
Soybean research	(500,000)	(500,000)	- -
Pest management research	(500,000)	(500,000)	- -
Rural development centers	(300,000)	(300,000)	- -
Transportation, marketing and storage	(500,000)	(500,000)	- -
Forage, pasture and range	(400,000)	- -	(-400,000
Soil erosion in Pacific Northwest	(350,000)	- -	(-350,000
Genetic vulnerability	(300,000)	(300,000)	- -
Pesticide clearance	(1,000,000)	(1,000,000)	- -
Environmental plant research in Hawaii	(75,000)	- -	(-75,000
Dried bean research in North Dakota	(25,000)	- -	(-25,000
Pesticide impact assessment	- -	(1,810,000)	(+1,810,000
Total, P. L. 89-106	17,852,000	19,213,000	+1,361,000
Rural Development, Title V			
Payments to States	1,440,000	1,440,000	- -
4% set-aside for Federal administration	60,000	60,000	- -
Total, Rural Development	1,500,000	1,500,000	- -
Federal Administration (Direct Appropriation)	1,228,000 *	1,696,000	+468,000
TOTAL, COOPERATIVE STATE RESEARCH SERVICE	126,765,000	136,687,000	+9,922,000

* Includes proposed pay costs supplemental.

AGRICULTURAL RESEARCH SERVICE

Purpose Statement

The Agricultural Research Service (ARS) was established on November 2, 1953, pursuant to authority vested in the Secretary of Agriculture by 5 U.S.C. 301 and Reorganization Plan No. 2 of 1953, and other authorities.

The Agency is responsible for conducting basic, applied, and developmental research of:

-- Animal production
-- Plant production
-- Use and improvement of soil, water, and air
-- Processing, storage, distribution, nutrition and food safety, and consumer services

The research applies to a wide range of goals; commodities; natural resources; fields of science; and geographic, climatic, and environmental conditions. It is categorized into 67 ARS National Research Programs and eight Special Research Programs.

The mission of ARS research is to develop new knowledge and technology which will insure an abundance of high quality agricultural commodities and products at reasonable prices to meet the increasing needs of an expanding economy and to provide for the continued improvement in the standard of living of all Americans. This mission focuses on the development of technical information and technical products which bear directly on the needs to (1) manage and use the Nation's soil, water, air, and climate resources and improve the Nation's environment; (2) provide an adequate supply of agricultural products by practices that will maintain a permanent and effective agriculture; (3) improve the nutrition and well-being of the American people; (4) improve living and rural America; (5) strengthen the Nation's balance of payments; and (6) promote world peace.

Under the authority of Section 104(b)(1) and (3) of Public Law 480, the Agricultural Trade Development and Assistance Act of 1954, as amended, ARS directs foreign research mutually beneficial to the United States and the host country which can be advantageously conducted in foreign countries.

The Agency's research is conducted at numerous field locations in the States, District of Columbia, Puerto Rico, the Virgin Islands, and in several foreign countries. Much of the work is conducted in direct cooperation with the State agricultural experiment stations, other State and Federal agencies, and private organizations.

Central offices for the Administrator of ARS and his staff, which are in the Washington, D. C. Metropolitan Area, provide overall leadership and direction to the programs and activities assigned to the Agricultural Research Service. The field activities are managed on a geographical basis through four Regional Offices, 20 Area Offices and seven major Research Centers.

Available Funds and Man-Years
1976 and Estimated, 1977 and 1978

Item	Actual 1976		Estimated 1977		Estimated 1978	
	Amount	Man-Years	Amount	Man-Years	Amount	Man-Years
Agricultural Research Service:	a/		a/			
Regular appropriation	$281,839,000	9,060	$280,589,000	9,474	$319,719,000	9,484
Scientific activities overseas (Special Foreign Currency Program)	7,500,000	15	7,500,000	15	7,500,000	15
Total	289,339,000	9,075	288,089,000	9,489	327,219,000	9,499
Deduct allotments to other agencies	-827,912	-15	-1,757,000	-15	-1,926,000	-25
Net	288,511,088	9,060	286,332,000	9,474	325,293,000	9,474
Obligations under other USDA appropriations:						
Animal and Plant Health Inspection Service--emergency programs and field station services	3,905,518	115	3,981,947	120	3,981,947	120
Food and Nutrition Service--improved dietary nutrition	296,005	17	348,898	17	348,898	17
National Agricultural Library--various services	303,467	- -	348,293	- -	348,293	- -
Soil Conservation Service--field station services	235,109	2	196,129	2	196,129	2
Economic Research Service--including P.A.S.A. and training of foreign nationals	825,660	29	3,032,446	60	3,032,446	60
Agricultural Marketing Service--field station services	129,399	- -	111,199	- -	111,199	- -
Coordinated Departmental Services	152,186	6	137,369	6	137,369	6
Miscellaneous reimbursements	7,582	- -	34,325	2	34,325	2
Total Other USDA Appropriations	5,854,926	169	8,190,606	207	8,190,606	207
Total, Agricultural Appropriation	294,366,014	9,229	294,522,606	9,681	333,483,606	9,681
Other Federal Funds	7,379,175	116	9,378,427	115	9,378,427	115
Non-Federal Funds	1,503,766	35	1,230,967	34	1,230,967	34
Total, Agricultural Research Service	$303,248,955	9,380	$305,132,000	9,830	$344,093,000	9,830

	1976 Actual	1977 Estimated	1978 Estimated
End-of-Year Employment:			
Permanent full-time	8,383	8,403	8,423
Other	1,436	1,350	1,350
Total included in ceilings	9,819	9,753	9,773
Number of disadvantaged youth	456	600	600
TOTAL	10,275	10,353	10,373

a/ Excludes $1,000,000 reappropriation.

(a) Agricultural Research Service

Appropriation Act, 1977		$270,576,000 a/
Budget Estimates, 1978		319,719,000
Increase in appropriation		+49,143,000
Adjustments in 1977:		
Appropriation Act, 1977	$270,576,000	
Supplemental Appropriations:		
Pay Costs	+10,013,000	
Adjusted base for 1978		280,589,000
Budget Estimate, 1978		319,719,000
Increase over adjusted 1977		$+39,130,000

a/ Excludes reappropriation of $1,000,000 of prior year funds for additional labor, subprofessional and junior scientific help in the field.

SUMMARY OF INCREASES AND DECREASES
(on basis of adjusted appropriation)

	1977	Increase or Decrease	1978 Estimate
Program Changes:			
Providing for food needs in the third century	$ 9,418,000	$+5,250,000(1)	$ 14,668,000
Competitive Grant Research Fund	- -	+27,600,000(2)	27,600,000
Repair and Maintenance	3,312,000	+3,904,000(3)	7,216,000
Pesticide Impact Assessment Program	- - a/	+1,020,000(4)	1,020,000
Annualization of pay increases effective FY 1977	10,013,000	+1,012,000(5)	11,025,000
GSA Space Rental	1,758,000	+258,000(6)	2,016,000
USDA Working Capital Fund Services	(4,515,000)	+536,000(7)	536,000
All Other	255,638,000	- -	255,638,000
Total, Program Changes	$280,139,000	$+39,580,000	$319,719,000
Facility Changes:			
Elimination of non-recurring facility items	450,000	-450,000(8)	- -
TOTAL AVAILABLE	$280,589,000	$+39,130,000	$319,719,000

a/ Excludes proposed supplemental of $1,020,000.

PROJECT STATEMENT
(on basis of adjusted appropriation)

	1976	1977 (Estimated)	Increase or Decrease	1978 (Estimated)
1. Research on animal production:				
(a) Animal production efficiency research	$ 48,638,068	$ 56,246,000	$ +1,180,000	$ 57,426,000
(b) Research on housing	377,017	368,000	+13,000	381,000
Total, Research on animal production	49,015,085	56,614,000	+1,193,000	57,807,000
2. Research on plant production:				
(a) Crop production efficiency research	90,041,144	105,496,000	+7,665,000	113,161,000
(b) Tropical and subtropical agricultural research	508,533	679,000	+11,000	690,000
Total, Research on plant production	90,549,677	106,175,000	+7,676,000	113,851,000
3. Research on the use and improvement of soil, water, and air:				
(a) Research on conservation and use of land and water resources and maintaining environmental quality	21,670,876	24,892,000	+1,389,000	26,281,000
(b) Research on watershed development	8,324,400	10,123,000	+230,000	10,353,000
Total, Research on the use and improvement of soil, water & air	29,995,276	35,015,000	+1,619,000	36,634,000
4. Processing, storage, distribution, nutrition and food safety, and consumer services research:				
(a) Processing, storage and distribution efficiency research	50,343,957	53,249,000	+565,000	53,814,000
(b) Research to expand agricultural exports	2,114,232	2,254,000	+51,000	2,305,000
(c) Food & nutrition research	9,179,039	13,969,000	+409,000	14,378,000
(d) Research to improve human health and safety	11,125,047	12,127,000	+447,000	12,574,000
(e) Research on consumer services	473,730	593,000	+20,000	613,000
Total, Processing, storage and distribution, nutrition and food safety, and consumer services research	73,236,005	82,192,000	+1,492,000	83,684,000
5. Competitive grant research fund	- -	- -	+27,600,000	27,600,000
6. Support services for other USDA Agencies	135,000	143,000	- -	143,000
7. Construction of facilities	29,930,000	450,000	-450,000	- -
8. Contingency research fund	a/	1,000,000	- -	1,000,000
Unobligated balance	9,977,957	- -	- -	- -
Subtotal	282,839,000	281,589,000	+39,130,000	320,719,000
Deduct reappropriation for:				
Special Fund	-1,000,000	-1,000,000	- -	-1,000,000
Total, Available or estimate	281,839,000	280,589,000	+39,130,000	319,719,000

	1976	1977 (Estimated)	Increase or Decrease	1978 (Estimated)
Supplementals for:				
Pay Costs	- -	-10,013,000		
Total, Appropriation	281,839,000	b/270,576,000		

a/ Obligations amounting to $922,980 of the $1,000,000 appropriated in 1976 are included in the projects above.

b/ Excludes proposed suplemental of $1,020,000 for Pesticide Impact Assessment Program.

EXPLANATION OF PROGRAM

Under the Agriculture and Related Agencies Appropriation Act of 1977, the Agricultural Research Service carries out the following activities:

1. Research on animal production.--Research is conducted to improve livestock productivity (including poultry) through improved breeding, feeding, and management practices and to develop methods for controlling diseases, parasites, and insect pests affecting them. Research is also conducted on improved rural housing.

2. Research on plant production.--Research is conducted to improve plant productivity through improved varieties of food, feed, fiber, and other plants; develop new crop resources; and improve crop production practices, including methods to control plant diseases, nematodes, insects, and weeds.

3. Research on the use and improvement of soil, air, and water.--Research is conducted to improve the management of natural resources, including investigations to improve soil and water management, irrigation and conservation practices; to protect natural resources from harmful effects of soil, water, and air pollutants and to minimize certain agricultural pollution problems, and to determine the relation of soil types and water to plant, animal, and human nutrition. The research includes studies on hydrologic problems of agricultural watersheds. Research is also conducted on the application of remote sensing techniques in meeting agricultural problems and on effects of the reduction of ozone.

4. Processing, storage, distribution, nutrition and food safety and consumer services research.--Research is conducted to develop new and improved foods, feeds, fabrics and industrial products and processes for agricultural commodities for domestic and foreign markets, including ways to minimize processing wastes. Research is conducted on the processing, transportation, storage, wholesaling and retailing of products; on human nutritional requirements; and the composition and nutritive value of food as needed by consumers and by Federal, State and local agencies administering food and nutrition programs.

   Research is conducted on problems of human health and safety, including means to insure the safety of food and feed supplies; control insect pests of man and his belongings; reduce the hazards to human life resulting from pesticide residues, tobacco, and other causes, and on consumer services.

5. Competitive grant research fund.--These funds will support competitive research grants to complement the efforts of USDA agencies, universities, and private research organizations. The objectives of this program are to emphasize basic research critical to food production and to obtain the participation of outstanding researchers in the entire U.S. scientific community.

The research performed by the Agricultural Research Service is authorized by the Department of Agriculture Organic Act of 1862 (5 U.S.C. 511) and the Research and Marketing Act of 1946, as amended (7 U.S.C. 427, 427i).

JUSTIFICATION OF INCREASES AND DECREASES

This budget proposed by the Agricultural Research Service for FY 1978 represents a net increase of $39.1 million. This includes an increase of $27.6 million for a Competitive Grant Research Program in FY 1978; $6.3 million for strengthening basic research efforts, and $5.2 million to meet other program requirements. This request responds to high priority problems facing the U.S. and world agriculture. It is consistent with Department policy, missions and goals; priorities identified by numerous study and advisory groups; short and long-range needs of action and regulatory agencies; and capabilities, missions and priorities of the Agency's programs judged to be cost-effective. The budget request follows the comprehensive review and evaluation of the Agency's base programs.

U.S. food policy and the role of agricultural science and technology in that policy has been elevated to a major national concern. This concern has been expressed through the International Food Conference in Rome, the Kansas City Food Conference, Congressional Oversight Hearings, the BARR and Interim Reports of the National Academy of Science, and countless scientific newspaper articles published over the past several years. The budget request is being made with an awareness that, as America looks ahead to its third century, an ever-expanding, interdependent world population will look to America for more food, more fiber, and more agricultural technology.

Expanding world food requirements and changing agricultural policies are placing added pressures on the U.S. agricultural research capacity which has been on a resource plateau for well over 10 years. Past research funding levels stand challenged as insufficient to sustain an aggressive export-oriented agriculture, to supply the incessant food demands of a world population that will nearly double in 25 years.

The budget request builds on a consensus of views on agricultural research needs. It is consistent with needs indentified at the Kansas City Working Conference on Research to Meet U.S. and World Food Needs and followup study by the Ad Hoc Work Group on Most Important Problems and the NAS/NRC/BARR Report on Enhancement of food Production for the United States.

The budget request is based on the assumption that reserve technology and new knowledge once in generous supply in agriculture are virtually exhausted. Also, the Agency has been seriously challenged by spiraling inflationary costs, a declining constant dollar budget, and a long-term trend of increased cost of conducting more sophisticated research.

The budget was built on the priority research needs identified through the public debate mentioned above, a review of base programs and redirection of research followed by the seeking of research proposals from ARS scientists to meet these priority needs. The research proposals were evaluated by panels of scientists, staff specialists and top managers according to proven criteria and a tested scoring model. The budget request was coordinated with action and regulatory agencies in the Department and with CSRS and ERS. It is supported by the Agency's new Management and Planning System (MAPS) used for the first time in planning for FY 1978. This system of National Research Programs containing technological objectives, program costs, and potential benefits and supported by a system of National Program Coordinators, Technical Advisors, and Analysts provides a new and developing framework for program, policy and budget analysis.

The priority increases are discussed in the following program packages. Following the narrative on the packages, a crosswalk table is presented which links the packages to the budget projects.

(1) An increase of $5,250,000 for providing for food needs in the third century. ($9,418,000 available in 1977)

The proposed increase will be distributed by program as follows:

(a) An increase of $50,000 for animal production efficiency research.

(b) An increase of $4,875,000 for crop production efficiency research.

(c) An increase of $325,000 for research on the use and improvement of soil, water, and air.

Objective: The primary objective of this proposal is to expand our base of fundamental knowledge sufficiently to assure a productive agriculture for the future. We must have the capability of meeting the future needs for food, fiber, and other renewable resources derived from agriculture.

Specifically, the subobjectives are to improve agricultural production capabilities by: (1) Improvement of crop production efficiency through fundamental knowledge of photosynthesis and nitrogen fixation and expanded use of cell and tissue culture technology for accelerating the modification of germplasm resources, (2) Improvement of the nutritional and other quality attributes of high-yielding food crops while maintaining yield potentials, (3) Improvement of the adaptability, productivity, and quality characteristics of forages; and development of improved forage and grazing management technology to promote increased livestock production, (4) Development of improved systems for pest control through growth regulation, innovative control technology, and expanded knowledge of pest organisms and chemical control agents, and (5) Expansion and improvement of the germplasm pools for crops.

Need for Increase: Use of sophisticated equipment, new technology, and enhanced needs since World War II have exploited nearly all of the fundamental knowledge on photosynthesis, nitrogen fixation, and cell culture that had accumulated during the previous two centuries. New findings have been assimilated so rapidly after they are generated that our "storehouse" of basic knowledge in these areas is essentially exhausted. A core of concerted research effort must be established to seek answers to unsolved basic problems on a timely basis if we are to compensate for our ever diminishing natural resources and satisfy the agricultural needs of our expanding population in the future.

Photosynthesis, Nitrogen Fixation, and Tissue and Cell Culture--At the present time, there is a critical need to understand more thoroughly the basic mechanisms of photosynthesis and nitrogen relations in all major crop species. Varietal differences in efficiency have been demonstrated but not explored. Tissue and cell culture technology has been successfully applied to only a few species. Potentials exist for increasing the photosynthetic efficiency of corn, sorghum, and sugarcane through breeding and varietal development. On the other hand, efficiency of most other crops may be amenable to genetic engineering of rate limiting mechanisms and control of photorespiration, as well as breeding and selection. Both short-term and long-term approaches have been outlined to capitalize on current knowledge of rhizobium-legume nitrogen-fixing associations and to improve these and other nitrogen-fixing processes. This proposal addresses nearly all of the researchable approaches outlined by a recent grant panel of the National Science Foundation for the areas of photosynthesis, nitrogen-fixation, and the technology for growing cells in test tubes or other artificial environment.

It should be possible to increase the photosynthetic efficiency of our less productive crops by as much as 30 percent. For wheat, such an increase would result in additional quantities to provide the food needs for wheat of nearly twice our present population without diminishing quantities for export. Similarly, the fixation of 20 pounds of nitrogen per acre in corn and wheat lands alone (116 million acres) would be the equivalent of some 1.2 million tons of nitrogen fertilizer and would save the equivalent of 8.1 million barrels of oil annually.

Improvement of Nutritional and Other Quality Attributes--High-yielding cereals and legume crops in many instances fail to meet quality and nutritional needs of consumers. These lower-priced, more abundant foods are often deficient in one or more essential amino acids, vitamins, or minerals, or in total content of protein.

Total nutritional requirements are met either through excess caloric intake and luxury consumption of some food constituents or in more costly dietary supplements and expensive food sources for variety. There is a need to improve quality attributes of a number of crops either to provide better balance in composition or increased quantity of desired constituents for specific end-use requirements. At the same time, it is imperative that yield potentials be maintained or improved.

A 5 percent gain in value of corn due to improved quality (both protein content and amino acid balance) would return a potential benefit of $125 million annually, based on the 1 billion bushels for food and industrial uses. Similar gains in all feed grains would nearly eliminate the necessity for high protein supplements in animal feed rations.

Improvement of Forages and Grazing for Livestock--Long-range research plans were implemented by ARS in fiscal years 1976 and 1977 to improve livestock production capabilities of land resources not suited for other agricultural uses. These include over 900 million acres of marginal lands used for pastures and western grazing lands on open range and forested areas. Much of the current vegetation of these lands has little or no forage value, but could be made productive through revegetation with adapted forage species and development of effective management practices. The varied requirements of the major range ecosystems demand a multidisciplinary research effort on each ecosystem for effective progress.

If forage quality could be increased to provide the bulk of animal nutritional needs, the sparing action on feed grains and protein-rich feed supplements for export purposes would be of tremendous importance. The long-term nature of this research makes it imperative that we augment current effort if significant effects are to be acheived even in the next 10 years. In addition, forage legumes, especially alfalfa, are thoroughly entrenched as important cash crops in the rotational cropping systems of most agricultural sections of the country. Their capacity to restore and conserve soil fertility is unexcelled. As hay and forages for grazing, they provide an important source of roughage in livestock feeding.

Carrying capacities on limited acreages of western grazing lands have been increased over 7-fold. At the present time, there are 71.5 million cattle on farms and ranches in the 19 Western and Great Plains states. If the vegetation of most of our western rangelands could be increased by just 3-fold, it would support more than twice the number of cattle needed for the entire nation. Improvement of forage quality would also greatly reduce the necessity for supplemental feeds.

New Pest Control Technology--Despite the sophisticated pest control technologies of today, pests continue to reduce the potential yield of our agricultural commodities by about one-third. Minimizing losses in agricultural commodities from only the more damaging insects, diseases, weeds, and nematodes annually costs billions of dollars and requires a wide variety of strategies, tactics, and tools. Every 3 years, a new insect pest appears in the U.S. Each 3 to 5 years, a crop variety that is resistant to common forms of an insect or pathogen becomes susceptible to a new biotype of the pest.

Unless the rapidly dwindling technical pool of knowledge of pests is dramatically increased, we will encounter more and more failures to control pests and will even experience difficulty in maintaining the present degree of control. The existing pool of scientific knowledge has enabled researchers to meet many different pest control challenges. However, there have been instances where alternative control methods were not available because fundamental knowledge was lacking or inadequate, such as fire ant control, gypsy moth control, and insecticide resistance. Efforts to rapidly develop new or improved pest control methods in the future will become more difficult and require more resources and time.

Increased knowledge of the more damaging pests will contribute significantly toward developing control measures that will minimize pest losses and reduce the costs of their control.

Germplasm Resources--Our major food, feed, and fiber crops are all genetically vulnerable to pests and environmental hazards. This is due in part to the narrow genetic base from which our highly productive modern varieties are structured. We must bring into the crop breeding system more genetic variability, learn to manipulate it through various breeding techniques in fashioning crop varieties that are less vulnerable to production hazards, and must provide safe maintenance for this basic genetic material upon which our crop agriculture depends.

Without adequate germplasm resources from which we can select breeding lines that are resistant to or tolerant of major stress factors, much of our $52 billion annual farmgate value of crops would progressively deteriorate. Continued expansion and effective maintenance and manipulation of these resources is imperative for crop improvement and the perpetuation of our agricultural system.

Plan of Work: The plan of work in each of the subcategories is as follows:

1. Crop Efficiency.

a. Photosynthesis--Clarify physiological and genetic bases for cultivar differences in yield, and expand studies on the spectrum of physiological and biochemical mechanisms of photosynthesis (bioenergetics, translocation, stress limitations, energy conversion, pigment reactions, and respiratory interactions) at interdisciplinary centers of excellence (located at Peoria, IL and Raleigh, NC).

b. Nitrogen Fixation--Improve symbiotic associations (beneficial relationships between different organisms living together)between selected legume and non-legume species and nitrogen-fixing bacteria ; quantify the rates and magnitude of nitrogen fixation under field conditions; and determine optimum environmental conditions, bioenergetics, and triggering mechanisms involved in nitrogen fixation. This work will be conducted as appropriate at locations in Maryland, California, Mississippi, Minnesota, Illinois, Colorado, and Alabama.

c. Tissue and Cell Culture--Techniques of growing in a test tube or other artificial environment will be used to accelerate improvements in corn resistance to the southern leaf blight organisms and carrot sensitivity to a phytotoxin at Madison, Wisconsin.

2. Nutritional and Other Quality Improvements--Develop improved methods for determining protein and nutritive value of major food and feed grains at Manhattan, Kansas, and cooperate with breeders and other scientists in improving these attributes in varietal development.

3. Forages and Grazing for Livestock--(a) Augment current research to improve yield and quality of selected forage species adapted to major forage-production areas of Oklahoma, Missouri, and Minnesota; (b) improve forage grass and legume seed production at Washington, Oregon, Utah, and Oklahoma; (c) expand research on the rapid determination of forage quality at Pennsylvania; (d) initiate research on weed control in pastures and forage crops of the Southern Region and expand research on biological and other methods for control of Mormon cricket and other insects in the Western and Northeastern Regions; (e) improve soil and water conservation practices for grazing lands in the Southeast; and (f) expand multidisciplinary research to develop and improve systems adapted for forage handling and animal management on Northeastern and Southern grazing lands and rangeland ecological communities of Wyoming and Montana.

4. Pest Control Technology--Expand research to develop new knowledge of the role of insect migration in causing outbreaks (Phoenix, Arizona; Stoneville, Mississippi); the chemistry of host plant resistance to attack by insects, nematodes, and other pathogens (Albany, California); the insect pathogens for control of major

insect pests with minimum pollution of the environment (Brownsville, Texas); the fate of fungicides in plants and animals (Fargo, North Dakota); the regulation of insect hormone systems (Beltsville, Maryland; Gainesville, Florida); and the use of behavioral chemicals to increase effectiveness of beneficial insects (Tifton, Georgia).

5. Expansion and Preservation of Germplasm Resources--(a) Establish a network of fruit and nut germplasm storage places as part of a joint State-Federal planning effort; (b) expand germplasm collections of selected crops; (c) evaluate these collections as sources of resistance to insects and diseases; (d) develop more efficient methods of combining multiple pest resistance in high-yielding adapted varieties; (e) maintain germplasm collections safely and efficiently as an essential resource; and (f) conduct on-site assessment of damage caused by non-resident (foreign) pathogens that constitute a potential threat to crops grown in the U.S. Research will be conducted at locations appropriate for selected crop species in Florida, Georgia, Maryland, Oregon, Pennsylvania, Kentucky, Washington, Missouri, Puerto Rico, and at regional plant introductory stations.

Redirections Made Last Year: In addition to continual redirected research emphasis within individual research projects to meet new challenges, the following significant shifts were made in base funds to strengthen as much as possible high priority areas for which increases are requested.

Research on technologies for feed use of forage crops were reduced and funds redirected to research on chemical regulation of photosynthetic processes in whole leaves of higher plants at Albany, California ($45,000, 1.0 SY).

Research on industrial uses of minor oilseeds was terminated and part of the funds ($16,000, 0.2 SY) was redirected to research on the chemistry of host plant resistance to insects, nematodes, and pathogen attack at Albany, California (remainder of funds redirected to research on nutrient analysis).

At the Beltsville Agricultural Research Center (BARC), 1 SY and $50,000 was shifted from research on air pollution and plant tolerance to research on legume root-environment interactions. Specifically, the effect of root pathogens, pesticides, plant residues, soil and air pollutants, and nutrients on infection of rhizobium, nodulation, and nitrogen balance in leguminous species.

The need for greater emphasis on basic research in the area of nitrogen fixation prompted the redirection of 2.4 SY and $80,000 at the Southern Regional Research Center from cotton finishing research to the study of nitrogen fixation in the absence of life with emphasis on the role of oxygen in oxidation-reduction reactions.

At Gainesville, Florida, 1 SY and $43,000 formerly devoted to genotype-environmental stress studies of tropical grasses were redirected to cooperative studies with state scientists to determine if symbiotic relationships can develop between nitrogen fixing bacteria and roots of tropical grasses.

At Brownsville, Texas, $190,000 was shifted from control of cotton and tobacco insects to research on Bacillus thuringiensis as a biological control agent for Heliothis.

At New Orleans, Louisiana, $37,000 was shifted from research on peanut products and cotton textiles to research on Bacillus thuringiensis to supplement the Brownsville, Texas, research on microbiological control of Heliothis.

At Athens, Georgia, $50,000 was shifted from research in support of industrial processing and cotton and tobacco health hazards to initiate research on photosynthesis with 1 SY transferred from Stoneville, Mississippi.

(2) An increase of $27,600,000 for a competitive Grant Research Fund.

Objective: Provide special emphasis on basic research areas critical to food production and to obtain the participation of those researchers throughout the entire U.S. scientific community who have outstanding expertise in these areas. The areas selected for support under this program are ones which possess exceptional opportunity for discovery of knowledge vital to the basic understanding of important biological processes and which can contribute to applied research on problems having great impact on food production.

Competitive grants are to complement the ongoing efforts of the USDA agencies, universities, and private organizations in order to sharpen focus and accelerate progress. Current base and inhouse programs must be continued and strengthened to assure core leadership of nationwide planning and program implementation and to assure continuity and relevance of competitive grant programs to other research missions.

Need for Increase: This is a Federal-State effort. The program proposed is in accordance with the Agricultural Research Policy Advisory Committee recommendations in U.S. food research. The program will strengthen the leadership role of the USDA-State Agricultural Experiment Station system in providing mission-oriented basic research on food. At the same time, it opens that system by providing support to other researchers. Also, the proposed program brings the USDA role in supporting research more into balance with National Science Foundation than has been true in the past. This program is to be assigned to ARS Budget for one year only, allowing opportunity for feasibility study on future assignment to CSRS with legislation if warranted. The four target areas selected for initial support possess great opportunity for fundamental scientific discoveries and contributions. Large work groups of scientists developed the research needs for these areas, including the 1975 Michigan Kettering Crop Productivity Research Imperative Conference. The mission-oriented basic research needs are described briefly below.

Photosynthesis--Since 95 percent of the dry weight of plants is a result of photosynthesis, studies on this process have high priority in efforts to improve crop productivity. Studies are needed to determine the fundamental biology involved in increasing net photosynthesis and to obtain more efficient partitioning of the products of photosynthesis into food products of high nutritional value.

Expansion of research is needed in three major subareas (a) identification of the aspects of photosynthesis which limit carbon dioxide input in natural environments, (b) relationship of plant development to photosynthesis, and (c) development of new methodology for plant breeders which would aid in identifying and incorporating improved photosynthetic efficiency into crops.

Nitrogen Fixation--Adequate supplies of nitrogen are essential to crop productivity. Increased crop yields during the past 25 years have parallelled increased use of nitrogen fertilizer. For several reasons, including energy and economic costs, improved or alternate technologies for providing nitrogen to crops need to be developed.

Genetic Engineering for Plants--Determine those plant processes and characteristics which can be used by plant breeders in manipulating plant genotypes to increase crop productivity. Biochemists and plant physiologists must be brought into direct and active team participation with plant breeders and other scientists who work with the genetic and cultural improvement of crops. Studies are needed to utilize pollen cell and tissue culture techniques to accelerate genetic improvement of crop plants.

Plant Protection--Plant pests are a major limitation to high crop productivity. Progress in reducing pest losses has been impeded by the rapid obsolescence of available technology, by various changes in production practices, and by the continued penetration of pests of foreign origin. Studies are needed on losses in production caused by pests, and the adverse environmental effects resulting from

pests and methods of combating them. The emphasis will be on pest insects, nematodes, weeds and pathogenic microorganisms.

Plan of Work: Research will be conducted on four crop productivity areas--photosynthesis, nitrogen fixation, genetic engineering for plants, and plant protection. Distribution of funds among the four crop productivity areas would be based on the selection of projects from all areas on the basis of their scientific merit, relevance and synergism with other projects. Grant managers and peer panels will be scientists who are competent in their specific fields and have demonstrated managerial capability. Participation of the best researchers throughout the entire U.S. scientific community who have expertise in the four selected areas will be solicited. Personnel from universities, private sector research, and government agencies will be eligible for grants.

(3) An increase of $3,904,000 for repair and maintenance of facilities. ($3,312,000 available in FY 1977.)

Objective: To restore ARS facilities to adequate working standards and to meet Occupation Safety and Health Administration (OSHA) and Environmental Protection Agency (EPA) requirements.

Need for Increase: An increase of $3,904,000 is requested to finance facility repair and maintenance needs in FY 1978. These funds are necessary to bring research facilities up to established standards for effective building and program management and to meet OSHA and EPA requirements. There are currently 1,464 buildings which were constructed prior to 1945. A recent survey indicated that over 50 percent of those surveyed are in less than adequate condition and in need of immediate attention. The generally poor condition of ARS laboratories is attributed to insufficient funds to cover repair and maintenance needs. Until fiscal year 1977, no funds had been appropriated for the specific purpose of repair and maintenance. Funds from research program effort have had to be diverted to provide minimal repair and other patchwork maintenance as such needs became intolerably evident.

Inflationary pressures within the Nation have been extraordinarily burdensome in recent years; the construction industry in particular has been hard hit. Similarly, the buying power of this Agency's redirected funds to meet repair needs has also diminished, and the practice of applying available funds on a very limited basis, as in past years, is totally inadequate to meet repair and maintenance needs today.

The policy of redirecting program funds to cover repair costs has proven ineffective and is responsible for the decayed and deteriorated condition of ARS facilities. Additionally, the lack of available funds has prevented the renovation of existing facilities to meet changing requirements in performing research, thus handicapping research progress. An effective facilities management program is needed at this time for the success of the Agency's research efforts. To delay further the implementation of an orderly repair, maintenance and modernization program will result in increased costs for such needs later.

Plan of Work: So that ARS facilities can be maintained in accordance with all Federal standards, and to keep them in satisfactory working condition to meet research program needs, ARS's repair and maintenance program should be adhered to as presently planned. Funds provided for these purposes in FY 1977 of $3,312,000 do not allow for the immediate needs of this repair program as previously determined and are inadequate to meet these needs as planned over the long-term program objective. The current planned program for repair and maintenance is based on a survey of all ARS research facilities' needs that would be required to bring them to acceptable levels of working conditions. The program as developed provides a comprehensive time-table for scheduled repair and maintenance over a period of 5 years. This plan considers all the repair and maintenance needs warranted and would be implemented on a priority basis. In order of priority, these needs would be (1) eliminating safety hazards and meeting health and environmental protection requirements, (2) prevention of loss of Federal property, (3) renovation of facilities to adequately meet program needs and (4) improvement of the appearance of ARS facilities.

(4) An increase of $1,020,000 for pesticide impact assessment

Objective: To establish a program for coordinating and managing ARS activities related to pesticide impact assessment. The program will be implemented as a coordinated effort by ARS, CSRS, ES, APHIS, ERS and FS.

Need for Increase: As increase of $1,020,000 is requested in FY 1978 for pesticide impact assessment. The present capability of the USDA is inadequate for dealing with the biological and economic benefits of pesticides. Presently, estimates on the effect of many pesticides are very subjective and based on limited data. With the requested funding and staffing increase, reliable estimates could be produced to provide greater confidence in the decision-making process.

The amount requested, $1,020,000, includes $376,000 to be transferred to Forest Service in FY 1978. Identical amounts are also being requested in a proposed 1977 supplemental. The proposal is a coordinated research effort involving both agencies in assessing the biological and environmental impact of pesticides.

The benefits and risks of continuing the uses of a large number of pesticides will be considered by the U.S. Government over the next few years. Decisions made in this regard, especially those related to reregistering existing pesticides for specific uses and registering newly developed pesticides, could impact significantly on U.S. agriculture.

Under 1972 Amendments to the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), the Environmental Protection Agency (EPA) was assigned authority for regulating uses of pesticides. Pursuant to this and subsequent legislation, EPA has a mandate to review all existing pesticide registrations and either reregister or initiate cancellation proceedings for specific pesticide uses by October 21, 1977. Issues related to registering new pesticides are expected to extend well into the 1980's. As of June 1975, there were about 30,000 Federal and 15,000 State registered pesticide products with approximately 1,400 active ingredients.

EPA has notified Congress of its intention to conduct indepth reviews for more than 100 pesticides before reregistration decisions are made. Of these, at least 25 are of significant importance for agricultural and forestry uses. The reregistration of a number of these pesticides may be challenged. The process EPA has developed provides for input from USDA.

Specifically, EPA, in carrying out its mandate, must notify the Secretary of Agriculture of EPA's plans to take actions. These actions include cancelling the registration of specific pesticides, conducting public hearings that may lead to cancellation and issuing regulations. The notification must be given 60 days prior to the intended action date. Responses must be given within 30 days and will be published in the Federal Register. These procedures provide an opportunity to develop objective, accurate data and analysis, and to define and evaluate benefits and risks of selected uses. Positive responses to these reregistrations and regulation actions require more resources. Currently, 3.6 Scientist Years and $284,000 are directly involved in pesticide assessment activities. ARS will redirect base funds to add 6.4 Scientist Years and $516,000 to this research in 1977. Similarly, Forest Service will redirect 3.0 man-years and $195,000 to this research in 1977.

Plan of Work

Agricultural Research Service

Assessment Teams: ARS staff scientists and analysts will join with representatives of other agencies in collection, appraisal, and evaluation of available data on benefits of selected pesticide uses for presentation of EPA's use in benefit/risk assessment, drawing on present and past ARS research. ARS contributions will include data on yields and production of crops and animals with and without use of pesticides and of their alternatives or substitutes (if any); degree of pest control of these pesticides (efficacy), and on quality maintenance of stored and

processed agricultural products with and without the use of pesticides or their alternatives and substitutes (if any). Analysis will also include information on the current recommended application levels of these pesticides. This biological information will be supplied to their economist counterparts on the assessment teams.

ARS scientists will conduct additional field experiments and laboratory research as needed to complete the data needs for the most critical pesticides. This will include research to determine current effectiveness of pest control, control effectiveness of selected alternative materials and methods, number of applications required and dosage rate, need for replanting as a result of pest damage, resistance problems, metabolism and residue after application and unanticipated contingencies. This will be done on a highly selective and targeted basis, based on findings of the Assessment Team and priority advice of our interagency Technical Advisory Group.

Forest Service

Forest Service scientists and analysts will join with representatives of other agencies in collection, appraisal, and evaluation of available data on benefits of selected pesticide uses. Forest Service contributions will include analyses of protection of forest and related resources, including timber products, with and without use of the pesticides and of their alternatives. Information on these pesticides will be supplied to economist counterparts on the Assessment Teams.

Forest Service scientists and their cooperators will conduct additional field experiments and laboratory research as needed to complete the data needs for the most critical pesticides. This will be done on a highly selective and targeted basis, based on findings of the Assessment Teams and advice of the Technical Advisory Group.

(5) An increase of $1,012,000 for annualization of pay increases effective in FY 1977. ($10,013,000 available in FY 1977).

(6) An increase of $258,000 for space rental costs pursuant to P.L. 92-313. ($1,758,000 available in FY 1977).

(7) An increase of $536,000 to cover increased costs for services provided through the Department Working Capital Fund. ($4,515,000 available in FY 1977).

(8) A decrease of $450,000 to eliminate non-recurring funds for purchase of land. ($450,000 available in FY 1977).

Need for Decrease: The 1978 Budget Estimates provide for a decrease of $450,000 to eliminate the non-recurring amount provided for the purchase of land at the U.S. Sugarcane Laboratory, Houma, Louisiana, in 1977.

Following is a cross-reference table relating the proposed increase packages to budgetary projects.

CROSS REFERENCE OF PROPOSED INCREASES TO BUDGETARY PROJECTS
(IN THOUSANDS OF DOLLARS)

Budgetary Project	Total Requested	Animal Production Efficiency	Crop Production Efficiency	Tropical & Subtropical Agriculture	Conservation & Use of Land & Water Resources	Watershed Development	Marketing Efficiency	Expand Agricultural Exports	Food & Nutrition	Improve Human Health & Safety	Consumer Service	Housing	Competitive Grant Research Fund
Proposed Increases (Packages)													
Providing for food needs in the Third Century.....	$5,250	$50	$4,875	- -	$325	- -	- -	- -	- -	- -	- -	- -	- -
Pesticide impact assessment program	1,020	87	480	- -	453	- -	- -	- -	- -	- -	- -	- -	- -
Repair and maintenance of facilities	3,904	964	1,723	$12	436	$174	- -	$39	$242	$298	$10	$6	- -
Annualization of pay increasea effective in FY 1977 ...	1,012	359	254	3	79	27	215	7	23	42	1	2	- -
Payment to GSA for rental of government-owned or leased space	258	52	97	1	23	9	49	2	13	11	1	- -	- -
USDA Working Capital Fund Service	536	107	201	1	49	19	102	4	27	24	1	1	- -
Competitive Grant Research Fund	27,600	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	$27,600
Total 1978 Budget Estimate increases	39,580	1,619	7,630	17	1,365	229	366	52	305	375	13	9	27,600
Redistribution of 1977 Repair and Maintenance increase	- -	-439	+35	-6	+24	+1	+199	-1	+104	+72	+7	+4	- -
Total increase and decrease on Project Statement	39,580	1,180	7,665	11	1,389	230	565	51	409	447	20	13	27,600

STATUS OF PROGRAM

The Service is a mission-oriented Agency concerned with research to insure an abundance of high quality and reasonably priced agricultural products to meet the needs of an expanding domestic and world economy, and contribute to continued improvement in the American standard of living. The Service uses coordinated, interdisciplinary approaches to conduct basic, applied, and developmental research in the fields of livestock, plants, soil-water-and-air resources, environmental quality, processing, storage and distribution efficiency, food and nutrition, consumer services, rural and international development, and agriculturally related health hazards, including food safety.

Research is conducted at numerous locations in the States, Puerto Rico, Virgin Islands and in several foreign countries. Much of the research is conducted in cooperation with the State agricultural experiment stations, other State and Federal agencies, and private institutions.

RESEARCH ON ANIMAL PRODUCTION

Current activities: Research is conducted to increase and improve the efficiency of producing high quality animal and animal products through improved genetic and reproductive capacity, feeding and management practices including the use of non-competitive feed sources, equipment, buildings and energy use and to develop better methods for controlling diseases, parasites, insects and other pests and hazards.

As the production of animal and animal products continues to rise in the United States and the world, there is a need for new technology to enable livestock producers to achieve greater production to assure a reliable supply of animal protein and at the same time reduce their production costs. These lower costs are thereby passed on in the market place to the consumer as lower prices of meat and other animal products. The following are selected examples of recent progress on animal production efficiency research.

Research on rural housing is conducted to provide knowledge and technology to help bring about improved designs, material, and construction methods for both low-cost renovation and new construction of housing suitable for low-to-moderate income rural residents.

Selected examples of recent progress: A description of these examples follows:

Calves by Sires of Large Breeds have Reduced Production Costs. Calves from matings of large-breed sires to medium-type cows of British breeds produced calves that are more efficient feed converters and had leaner carcasses. The results can reduce the retail cost of this beef by 6 cents per pound.

Hormone Treatment Used to Improve Reproductive Efficiency in Swine. Injections of hormones would permit the breeding of young females as early as 160 days of age and permit rebreeding during nursing. Treatment of these young females prior to puberty with a synthetic hormone resulted in pregnancy at the rate of 65 percent.

Marketing Lambs at Heavier Weights Increases Efficiency. Selection procedures that identify parents with genetically superior characteristics will increase the ability of lambs to reach heavier market weights at 14 to 22 weeks of age and still maintain acceptable carcass and meat quality. Net returns to the industry due to the increased efficiency is estimated at $3 million a year.

More Efficient Utilization of Animal Byproducts as Feed. Poultry offal meal, a byproduct of the poultry industry, is used as a poultry feed ingredient. ARS research has standardized the processing method to maximize the feed value, the protein quality, and the uniformity of the feed ingredient. These improved characteristics increased the overall value of offal meal as a poultry feed.

New Poultry Brooding Systems Reduce Energy Requirements. A new concept in brooding in which a limited area is used within the house for brooding reduced the fuel required to grow broilers in mid-winter in Mississippi from 90 gallons of liquified petroleum gas per 1,000 chickens to 30.5 gallons per 1,000 chickens. Use of solar energy in conjunction with limited area brooding reduced fuel requirements to 8.2 gallons per 1,000 chickens.

New Procedure(s) Helps to Understand Resistance to Brucellosis. A laboratory procedure has been developed at the National Animal Disease Center at Ames which represents further progress toward determining whether an animal's resistance to brucellosis is a result of vaccination or actual field infection. Such information is essential for the eradication of cattle brucellosis in the United States.

Inexpensive Test for Diagnosis of Influenza Infection of Birds and Mammals, Including Man. The demonstration of antibody in the serum of animals or man previously infected with influenza viruses has in the past been accomplished by a complicated test requiring considerable labor. An ARS scientist developed a fast, inexpensive test that is currently in use in most animal and human diagnostic laboratories.

Bluetongue Virus (BTV) Can be Spread by Infected Semen. A bull showing no signs of the disease although shedding BTV in semen was bred naturally to several susceptible heifers. ARS research has shown that BTV can be spread by semen causing reproductive problems in the females, including abortion and failure to breed. Most surviving calves from these matings were carriers of BTV.

Plant Extract Repels Coyotes. In many areas, coyote predation has seriously restricted sheep and goat production. ARS field studies and controlled research have confirmed that when certain extracts of the bitterweed plant were sprayed on the wool of sheep, the predation by coyotes was significantly reduced for about 60 days. The extract was not toxic to sheep.

New Screwworm Trap and Attractants Developed. A new screwworm trap using a chemical attractant instead of rotting liver has been adapted by APHIS. This trap design and attractant, products of ARS research at Mission, Texas, catches more screwworm flies and less extraneous flies than the standard liver baited trap. The new trap is easier to handle, more effective, and cheaper than the standard trap which was designed about 40 years ago.

Low-Cost, Solar Collector Reduces Rural Home Heating Costs. An attic solar collector was developed and proven practical for heating rural homes in the Southeast. Solar heat transmitted through the roof to attic floor collectors satisfied nearly all the house heating requirements for a Greenville, South Carolina, experimental house. The system will particularly be useful for low-income families who could arrange for paying for the added collector costs but are having great difficulty meeting their escalating monthly fuel bills.

USDA-DHIA Sire Summaries and Cow Indexes have Accelerated Genetic Progress in Dairy Cattle. A study of nearly three million production records shows little genetic progress between 1960 and 1967. From 1967 to 1975, 34 percent of the 942 pound gain per cow in milk production resulted from improved genetic merit. During this period, use by dairymen of USDA-DHIA Sire Summaries and Cow Indexes has been a primary factor in genetic progress in dairy cattle.

RESEARCH ON PLANT PRODUCTION

Current activities: Research is conducted to improve productivity and quality of food, feed, forage, and fiber crops; florist and nursery crops; and turf. Emphasis is on research to improve genetic stocks and varieties, increase yields and quality of crops, improve mechanization and crop production practices, enhance environmental quality, and improve crop protection technology, including biological and chemical methods to control diseases, nematodes, insects, and weeds, and to alleviate the effects of adverse environmental conditions through hardier plants. Research is carried on in related areas of tropical and subtropical agriculture.

New multidisciplinary concepts for increasing our productive capacity have been initiated. Special emphasis has been placed on improving basic photosynthetic processes in plants, natural nitrogen-fixing processes in soils and plants, better use-efficiency of both renewable and non-renewable energy resources, and control of plant growth and development.

The quality of our environment can be improved by the development, appropriate use, and care of attractive shelterbelt screening, ornamental trees, shrubs, turf, ground covers, and flowers. There are an estimated 75 million acres of cropland affected by wind erosion, the adverse effects of which could be reduced by shelterbelt screening. New knowledge to preserve attractive and eliminate unattractive environmental conditions is needed by rural and urban property owners throughout the nation.

Selected examples of recent progress: A description of these examples follows:

A New High Yielding, High Solids, Pest Resistant all Purpose Potato Variety Developed. The 'Atlantic' potato variety was jointly released by and is widely adapted for growing in Florida, Virginia, New Jersey, and Maine. It possesses the highest total solids content of any potato variety grown in the United States, important to processors. Atlantic is immune to virus X, late blight, and highly resistant to golden nematode, scab, and field rots.

Corn and Sorghum Scientists Reduce Genetic Vulnerability to Pests. A broad genetic based corn breeding population was released in 1975. The population has multiple pest resistance to European corn borer, two virus diseases and northern leaf blight fungus and superior yield performance. A new broad genetic base in sorghum has been developed which should greatly reduce our dependence on one male sterile system in sorghum hybrid seed production.

Tobacco as a Source of High Quality Protein. ARS scientists have discovered a high quality protein byproduct of tobacco production which could become a source of food for humans and animals. This protein has been separated in small quantities from the cell sap during the homogenized leaf curing process. There is potential for removal of 40-60 pounds per acre of the material based on amino acid composition.

Introduced Weevils Released in Three Additional States for Control of Thistles. A weevil discovered in Europe and first introduced in Virginia in 1969 has recently begun to reduce musk and plumeless thistles significantly. In 1975-76 several thousand of the weevils were collected in Virginia and now have been dispersed to 28 sites in Maryland, New Jersey, and Pennsylvania in cooperation with organizations in these states.

Taxonomic Analysis of all Western Hemisphere Relatives of the Mexican Bean Beetle Provides Base for Biological Control Explorations. The 288 New World beetle species allied to the Mexican beetle were defined, characterized and known geographic distributions mapped. This will allow more effective search for biological control agents of the pest.

Hybrid Sunflowers Developed by ARS. These hybrids, developed by ARS scientists during the past 6 years by selection and breeding among open-pollinated Russian and wild North American sunflowers, were used in more than 90 percent of the 1976 North American sunflower acreage. Yield Increases from them are estimated at 10 to 20 percent.

A New Versatile Pecan Variety Released. Kiowa, a new pecan variety suitable for southeastern and southwestern United States, has been released by the U.S. Pecan Field Station, Brownwood, Texas. This is the 15th varietal release by ARS scientists at Brownwood. Kiowa is precocious, prolific, and suitable for high density planting, as a temporary tree, or as a permanent tree if pruned to regulate tree size.

First Blueberry Variety Resistant to Root Rot Developed. A new variety named Patriot, known to be resistant to root rot, has been jointly released by ARS and the University of Maine. Patriot is hardy, capable of withstanding lower temperatures and is more productive than any other highbush blueberry grown in its adapted area.

New Method Developed for Increasing Plant Mutations. Mutations critically needed for improving hybrid millet have been induced by ethidium bromide (EB). This discovery offers new opportunities for developing high hybrid vigor and higher yields in food crops.

Improvement of Nitrogen Fixation Capacity of Alfalfa. When alfalfa plants selected as high nitrogen fixers were crossed, their progeny were also high fixers. Conversely, progenies from crosses between low fixers were likewise low fixers. This opens the way for development through breeding of alfalfa varieties with even greater nitrogen fixing potential.

First Wheat Variety Resistant to Greenbug. ARS and Oklahoma State University scientists successfully transferred greenbug resistance from rye to wheat. This research will greatly benefit wheat production. The greenbug (a plant aphid) is the most damaging insect pest of wheat in the Great Plains, and recently invaded the Northwest.

DNA Similarities in Host Plants and Viruses. Sequences of the genetic material DNA have been found in potatoes which correspond to the same genetic material found in a virus which can attack potatoes. This suggests that the virus may have originated from genetic material in the host plant. This is important knowledge for helping develop virus-free potatoes.

Development of Hybrid Cucumbers Made Possible. Nearly half of the cucumbers offered for sale were developed from plant introduction selections discovered at the Northeast Regional Plant Introduction Station. One of the most recently developed cucumber strain produces only female flowers, making it extremely useful as the female parent in producing commercial cucumber hybrids.

Friction Separator Device Improves Separation of Weed Seeds from Alfalfa Seeds. Alfalfa-dodder mixtures were separated with a scale model friction separator. Removal of 99.9 percent of the dodder seeds was accomplished with approximately a 0.2 percent loss in alfalfa seed. The estimated benefit by the seed processing industry from this development will exceed $1,000,000.

Mechanical Rhubarb Harvester Reduces Labor and Cost. ARS scientists at East Lansing, Michigan, developed a mechanical harvester for rhubarb that reduces labor by 50 percent and harvesting costs by 25 percent. Rhubarb production is a small industry, small producer business, and close to extinction without help such as mechanical harvesting.

Recirculating Sprayer Increases Selectivity of Johnsongrass Control in Soybeans at Reduced Cost. The most effective foliar-applied herbicide for johnsongrass control is too toxic to soybeans for conventional applications. A recirculating sprayer has been devised which provides excellent johnsongrass control with little soybean injury using available effective herbicides. Material not deposited on the weed is trapped and returned to the spray tank for reuse.

Offspring Obtained from Honey Bee Semen Stored in Liquid Nitrogen. For the first time, progeny were produced from honey bee semen stored in liquid nitrogen. If stored sperm remains viable for several years, the method will provide unlimited storage potential to bee stock centers and much improved bee breeding opportunities.

New Herbicide Developed for Control of Wild Oat and Other Weeds in Wheat. Wild oat reduces wheat yields in the U.S. approximately five percent annually. For North America, these losses are valued at more than one-half billion dollars. Current wild oat control practices are not adequate. The new herbicide kills wild oat by inhibiting a natural plant hormone, but wheat is not affected.

A Bacterial Insect Toxin Developed to Replace Pesticidal Chemicals. A common bacteria found in soil all over the world produces a crystalline material that is extremely toxic to insects. The toxic feature of the material is not activated in mammals. Therefore, this product is safe to animals and humans and is a plausable alternative to pesticidal chemicals now used to protect grain storage and field crops.

Research Responds to Citrus Blackfly Threat. ARS scientists in both Florida and Texas have made highly important contributions to the effort to control a new infestation of citrus blackfly in southeastern Florida. Two different species of parasites have been introduced, become established, and are now showing an effect on the infestation. A new trap for detecting and monitoring infestations was developed.

Research Makes Eradication of Medfly from Los Angeles Possible. Technology developed by ARS scientists enabled State, Federal, and local action agencies to successfully eradicate an infestation of the Mediterranean fruit fly from Los Angeles. In addition to technical advice and assistance, ARS supplied over 500 million sterile medflies for the operation.

Plant Growth Regulators for Insect Control. New chemicals applied to cotton for terminating late season fruiting greatly reduces pink bollworm populations. This practice, particularly when used in conjunction with nectarless varieties and judicious use of insecticides, could substantially reduce the quantity and cost of chemical insecticides and increase the efficiency of cotton harvesting.

Increased Resistance to European Corn Borer by Combining First and Second Generation Resistance. Over 21 million acres of corn are planted to hybrids with resistance to first-generation European corn borers. This method has reduced damage to first-generation borers, but late season borers have not been controlled. ARS scientists have now combined first and second-generation resistance into one corn type to provide first and second generation resistance.

Sterile Male Insects can be Produced Through Hybridization. When male tobacco budworms, a serious crop pest, are crossed with females of a related species, the male offspring are sterile. The hybrid females cross readily with tobacco budworm males in the field and again produce sterile males and fertile females for at least 40 generations. Thus, these hybrids may be used to suppress pest populations without the use of chemicals..

Molecular Models Discovered for Safer Insecticides and Nematicides. A family of fairly simple chemical compounds has been discovered which destroys insects and nematodes. These candidate pesticides are more versatile than juvenile hormone-like materials because they disrupt development during all immature stages of the pests. They have many potential uses for pest control.

Potent Attractant Found for Japanese Beetle. Female Japanese beetles attract males by emitting a potent perfume. This sex attractant has been chemically identified and synthesized. The synthetic attractant has been successfully tested in the field. Formulations of this attractant and a food attractant are being developed for detection of beetles in previously uninfested areas, for measuring densities of the pest population, and for their possible control.

Photosynthate Partitioning is Genetically Controlled. Photosynthate, the immediate product of photosynthesis, is transported from leaves to various parts of the plants and is then partitioned into the yield of crops. The efficiency with which photosynthate is partitioned in crops affects the yield potential. Genetic control of partitioning has been identified in sugarbeet and alfalfa which can aid breeders in developing superior yielding varieties.

RESEARCH ON THE USE AND IMPROVEMENT OF SOIL, WATER, AND AIR

Current activities: Research is conducted to improve the management of natural resources, including investigations to improve soil and water management, strip mine reclamation, salinity control, fertilizer efficiency, tillage practices and machines, irrigation and drainage practices, and to determine the relation of soil types and water to plant, animal, and human nutrition. The research includes studies on management of organic matter in soils, better crop residue management, and more effective use of agricultural, urban, municipal, and industrial wastes as fertilizer supplements and soil conditioners on agricultural and other land areas. Hydrologic problems of agricultural watersheds are being studied, as well as the use of remote sensing techniques in solving agricultural problems. Research is also being conducted on agricultural pollution problems such as protection of plants, animals, and natural resources from harmful effects of soil, water, and air pollutants, and ways to minimize and utilize industrial processing wastes of agricultural commodities. Several ways to conserve energy in agriculture are being explored as part of the above activities.

There is a need for land and water resource improvement to maintain and improve the quality of the environment and the natural resource base, to stabilize crop yields during climatic extremes, and to enhance the development of rural communities.

Selected examples of recent progress: A description of these examples follows:

Yields of Small Grains on Sodic Soils Increased by Deep Plowing. Sodium-affected soils of the Northern Great Plains frequently have gypsum present in the subsoil. ARS scientists have shown that deep plowing to destroy the impermeable layer and to mix subsoil gypsum into the root zone increased wheat yields by 9 bushels per acre per year during the last 5 years.

New Irrigation Technology Offers a Variety of Benefits. ARS improved irrigation in Colorado, reduced salt loading in the Colorado River, used less water and fertilizer, and increased corn production. Similar results were achieved on citrus in Arizona. Optimum yields of sorghum in Texas resulted when limited amounts of water were applied at critical growth stages. In Nebraska, irrigation scheduling avoids periods of peak power use, saves energy, and reduces irrigation pumping costs.

Procedures Developed for Simulating the Geographic Structure of Watersheds. Recent studies at Tucson, Arizona, have identified the procedures needed for characterizing and simulating watersheds of complex topography. This information is necessary to predict the impact of land use and management on the quality of water in the Nation's streams.

A Reduction in Net Photosynthesis was the Principal Effect of Water Stress. In a field study of a number of soybean varieties, photosynthate fixed in the leaves was transported primarily to the seed, and transport to the root system and the nodules was drastically reduced at onset of fruiting. This directs us to develop management systems that optimize water supply during the fruiting period.

Bench and Outer Slope Areas of Strip Mines Stabilized Using Vegetative Cover. Bench and outer slope areas of strip mine spoils can be stabilized against erosion and subsidence. Two species of bermudagrasses were successfully established on spoils treated with raw rock phosphate or lime plus fertilizer. Contoured grooves on steep outer slopes aid establishment of vegetative cover.

Nitrogen Use Efficiency Relationships Quantified for the Northern Great Plains. The relationship between nitrogen-use efficiency and nitrogen-fertilization rates was quantified and equations developed. The number of cows an acre of pasture can support was doubled with the addition of 50 pounds of nitrogen per acre in a cow-calf grazing study. Each pound of nitrogen-fertilizer produced about 20 pounds of dry forage, which in turn, produced 2 pounds of beef.

Breakdown Rate of Pesticides in the Free Atmosphere was Measured. Techniques for increasing photochemical degradation rates of pesticides in the free atmosphere have been developed by ARS. These findings should have major significance in assessing atmospheric transport of pesticides.

Land Application of Sewage Sludge Environmentally Safe, Saves Fertilizer and Energy. Sludge-treated infertile sandy Minnesota soil produced over 200 bushels of corn per acre during the past 2 years. No soil or water pollution was detected during this time nor was crop quality impaired. In addition, energy was saved by minimizing the need for fertilizer and eliminating expensive incineration.

Wind Erosion Reduces Soil Productivity. Recent experiments using newly developed procedures show that wind can erode from 1/4 to 1-1/3 inches of surface soil each year from the Great Plains. These soil losses, in turn, can result in annual yield losses of 1/3 to 2 bushels of wheat and from 1/2 to 3 bushels of grain sorghum per acre. Also, accompanying air pollution from dust and associated farm chemicals is a major problem.

Suspended Sediment Measured by Remote Sensing. Knowledge of suspended sediment loads is needed for wise management of reservoirs and land. Reliable estimates of suspended sediment have been made from measurements of solar radiation reflected from water surfaces of lakes.

Agricultural Applications of Solar Energy. Through ARS managed research projects, the technical feasibility of curing or drying several kinds of crops and of heating livestock shelters and greenhouses was demonstrated. Future economic feasibility is promising for use of solar energy in tobacco curing, greenhouse heating, and heating ventilation air for swine and poultry shelters.

PROCESSING, STORAGE, DISTRIBUTION, NUTRITION AND FOOD SAFETY, AND CONSUMER SERVICES RESEARCH

Current activities: Research is conducted to improve the efficiency of processing, storage, and distribution of agricultural products. Studies include the development of new and improved food, feed, fiber, and industrial products and processes, and utilizing renewable agricultural commodities in order to maintain and expand domestic and foreign markets for farm crops. Studies also involve quality evaluation, transportation, storage, wholesaling and retailing of products, to reduce costs of marketing, to maintain product quality, to reduce losses from waste, spoilage, insect festation, and pollution.

Research is conducted on human nutritional requirements, composition and nutritive value of foods to provide information needed for consumers and for Federal, State and local agencies administering food and nutrition programs.

Research is conducted on problems of human health and safety. Studies concern developing means to insure food and feed supplies and products free from toxic or potentially dangerous residues, harmful chemicals, and microorganisms introduced from agricultural sources, or during processing operations. The research conducted also includes studies concerning means to control insect pests of man and his belongings; prevent transmission of animal diseases and parasites to man; reduce the hazards to human life resulting from pesticide residues, toxic molds, tobacco, and other causes; and, develop technology for the detection and destruction of illicit growth of narcotic-producing plants.

Research is conducted on consumer services by studying family use of resources, by identifying budgeting problems of families, and by providing information on fabric performance and the use and care of clothing and household articles by consumers.

Selected examples of recent progress: A description of these examples follows:

Rapid Method for Determining Sprouted Wheat Damage. A method was developed for the rapid, convenient detection and estimation of sprout-damaged wheat by colorimetric determination of a characteristic enzyme. The method requires only 5 minutes incubation time, no elaborate equipment, and is simple to use.

ARS Research Facilitates Exportation of Grain. Scientists developed insect control techniques that allow infested grain to proceed to destination under fumigation. These new procedures eliminate hazards to inspectors, resulting in substantial savings in payment of excessive demurrage charges.

Basic Research Gives Clue to Fruit Aging. Apple tissues of various ages were treated with plant hormones to determine their anti-aging effects after harvest. Only the hormones, cytokinins, were effective in suppressing ethylene production suggesting that these compounds might be used to extend the storage and marketing life of the apple.

New Packaging Concept Protects Peanut Quality and Eliminates the Necessity of Refrigerated Storage. Roasted or raw peanuts placed in closed environment such as a plastic bag, flushed with carbon dioxide, and heat sealed will maintain their freshness for months without refrigeration or other treatment. Insect infestation is also eliminated. Other oilseeds such as pecans, cashews and almonds can also be packaged by this method.

Whitewashing Reduces Sunburning of Melons. Over $3 million worth of cantaloupes were lost in 1975 as a result of sunburning in the San Joaquin Valley alone. Whitewashing melons during growing season can substantially reduce the incidence of sunburn. Whitewash is inert and nontoxic and has no effect on the sugar content or other quality factors.

Increasing the Value of Tallow. A fatty acid derivative synthesized by ARS chemists has great market potential for increased higher value use of tallow. Engineering research resulted in a continuous, optimized and economically attractive process which has stimulated development and commercialization by an American licensee who expects substantial production by August 1977.

Wood Preservative Protects Timber in Marine Environment. Research on biologically active substances led to isolation of compounds which completely protect pine wood on long exposure in the marine environment. Potential use of this chemical as a wood protectant against termites is currently being tested. If applied generally, annual benefits could amount to several hundred millions of dollars saved in timber replacement and the use of lower cost woods.

Handling Systems for Frozen Food have Different Efficiencies. Systems for handling and transporting frozen food from the processing plant to the wholesale warehouse were analyzed. The most efficient system results in a savings of over $11 per trailerload, or an annual saving of over $3 million.

Dye Test Measures Sanitary Condition of Ground Beef. A dye reduction method was developed for estimating the level of microbial contamination in ground beef. After further research, meat wholesalers, retailers and consumers may be able to estimate the bacterial content of a package of ground beef by visual observation of color changes in an indicator disc placed on the meat surface at the time the meat was packaged.

New Techniques Keep Meat Fresher Longer. Introducing a controlled gaseous atmosphere into individual meat packages can preserve freshness for longer time periods than with conventional packaging. Meats also retain their bright red appearance longer. Currently, the average store may remark 7-8 percent of its conventionally packaged meat and may lose 50 percent of the original price.

Urban Wholesale Market Studies Continue. The study on Improved Food Distribution Facilities for Asheville, N.C., is published and the State has appropriated $1 million to initiate the plan. The study for Memphis, Tenn., is complete and a report is being prepared. A study for Northeast New Jersey is underway which involves an 8-county area with over 1,600 wholesale food firms. Urban wholesale markets have been built or are under construction in 40 of the 70 cities where ARS studies have been completed.

Pollution Control in Poultry Processing Plants is Improved. A new pneumatic waste handling and transport system for poultry processing plants prevents the waste products from entering the plant effluent, thus significantly reducing the pollution load. Potential $10 million savings to industries.

Additives can Effectively Reduce Cotton Dust in Mill Processing. Card room dust levels are reduced significantly when hydrocarbon oil-based additives are applied in very small amounts under controlled conditions to raw cotton prior to processing. Achieving similar reductions in atmospheric cotton dust levels by air filtration methods would be more costly.

New Machine Converts Staple Fibers Directly into Yarns. The machine converts tufts of loose cotton directly into yarn ready for knitting or weaving. The new method eliminates six or more separate textile mill processing steps, can save one-half of present mill floor space and labor, and requires only three-quarters of the energy now used in conventional mill processing.

New Method for Dyeing Wool Yarns Produces Novel Color Effects. A simple modification of the conventional package dyeing process produces randomly or periodically dyed yarns with two or more colors along the length of the yarn which after knitting or weaving produces color effects and patterns unobtainable by printing or other means. This process will assist users of wool yarns to expand fashion interest for wool textiles.

Zinc Deficiency in Pregnant Animals Affects the Brain and Behavior in Offspring. Offspring of rats deprived of zinc in the third period of pregnancy showed impaired fetal brain growth and neurological development as well as behavior changes. Infants of rhesus monkeys deprived of zinc from day 110 to 150 of pregnancy displayed decreases in activity, play, exploration, and nursing. These findings have implications for pregnant women who have impaired zinc nutriture.

ARS "Thrifty" Food Plan Used as the Basis for Food Stamp Allotments. The "Thrifty" food plan takes into account the 1974 Recommended Dietary Allowances of the National Academy of Sciences and new information on food consumption, nutritive value of foods, and food prices. The plan demonstrates how families can plan varied meals which supply adequate nutrients at low cost.

Women Taking Oral Contraceptives Need Dietary Counseling. In young women using oral contraceptives, changes were observed when a high sugar diet was consumed that could adversely affect women with metabolic disorders and might precipitate latent conditions such as diabetes or high blood lipids which are associated with heart disease and stroke.

Consumers Choose ARS Bulletins on Food and Nutrition. A Guide to Good Nutrition tops USDA's distribution lists in popularity with a distribution of 466,000 copies for the past calendar year. Other consumer publications sought include Freezing of Fruits and Vegetables; Home Canning of Fruits and Vegetables; Food and Your Weight; and Vegetables in Family Meals: A Guide for Consumers.

Over 140 Consumer Publications Printed in Home and Garden Series in 1976. These included three new publications, 36 revisions, and 103 reprinted. In addition, ARS produced 31 new correspondence aids—small leaflets that answer current questions. These are in addition to farmers' bulletins and technical publications.

PROGRAM EVALUATION

Current activities: In 1975 as part of the Department's Program Evaluation System, the Service initiated a pilot study in the evaluation of research programs. The study was designed to determine if the impacts of research on broad social and economic goals can be identified and measured. In at least some cases such impacts can be measured. In general, however, it is extremely difficult to separate the impacts of the public sector research from those of the private sector, as well as the impacts of ARS research from those of other public research. Further, an evaluation of agricultural research must usually be over some fairly long period of time to allow for the development of new technology and its adoption. Program evaluations in research tend to give more comprehensive views of research than do descriptions of individual examples of scientific achievement. Three selected examples of the results of these evaluations follow:

1. Improved Soybean Harvesting Procedures and Equipment. Research conducted primarily by ARS scientists on soybean harvesting equipment and techniques between 1968 and 1973 has enabled an increase in harvested beans during that time having a value equivalent to a return on investment of 1,000 percent compounded annually over the period. It has also provided the technology for a continuing flow of benefits estimated to range from $161 million in 1974 to $259 million in 1980 and totaling $1.5 billion. This is a magnificent bonus to follow for only 6 years of research costing less than $0.8 million.

   The ratio of benefits to cost from both the continuation of past benefits and the expected additional benefits to 1980 is 940:1. This estimate is based on the net benefits from past improvements continuing until 1980 at the average level of 1972-73, the expected further savings from further adoptions, continued research expenses at the 1974-75 level, and discounting both costs and benefits to 1968 at 7 percent. The net benefits to a typical producer after allowing for amortizing and operating his new equipment are estimated to be $2.50 per acre over all his acres for conversion to a floating cutterbar and $1.35 for adding air jets.

   The research leading to these remarkable achievements was planned in 1968 by ARS Agricultural Engineering researchers to reduce the percentages of soybeans known to be lost and damaged in the harvesting and handling process. Specific objectives were to: (1) reduce harvesting losses from 10 percent to 4 percent of the crop produced; (2) reduce harvesting damage from 30 percent to 5 percent; (3) reduce handling, drying, and storage losses from 1.0 percent to 0.5 percent; and (4) reduce handling, drying, and storage damage from 10 percent to 5 percent. The work was carried out cooperatively with the University of Illinois in its facilities at Urbana and was coordinated with related efforts at other State Agricultural Experiment Stations. ARS funding and research activity accounted for more than one-half of the total involved. It was decided to concentrate on that area offering the greatest potential benefit, the reduction of harvesting losses. This was to be accomplished by a two-thrust program: (1) evaluating existing soybean harvesting equipment and devising improved and more efficient techniques for its use and (2) developing new harvesting equipment.

Completion of the first thrust resulted in new knowledge of machine capabilities and improved harvesting techniques that enabled the reduction in soybeans lost at harvesting from 10 percent in 1968 to approximately 8 percent in 1973. The total additional return up to 1973 after paying for additional cutterbars was $285 million. This was attained at a total machinery research cost over the 1968-73 period for all institutions of $0.8 million. If all of the benefits could be attributed to the research, it would be equivalent to a rate of return through 1973 of 1,000 percent, which would mean that every dollar invested in this research during this period had returned $10 per year compounded annually from the time of its investment until 1973.

Although knowledge of more effective equipment settings and adjustments and generally improved harvesting techniques contributed to the 2 percent reduction in loss cited above, a major part of the reduction resulted from evaluation and adoption of the floating cutterbar header. This is a commercially available pre-existing combine attachment which, when properly used and adjusted, enables reduction of harvesting losses to about 6 percent when harvesting soybeans below 13 percent moisture.

In addition to the evaluation of existing equipment and development of more efficient practices for its use, ARS scientists by 1973 had tested, and successfully demonstrated to industry engineers a new combine header utilizing an entirely different principle of operation. This header achieves the initial lifting of the severed plant material onto the header by appropriately directed jets of air. Tests over a two-year period indicate the capability of the air jet header, when used in conjunction with the floating cutterbar, to reduce losses from the expected 6 to 10 percent down to less than 2.5 percent when harvesting soybeans at 12 percent moisture.

Research continues on techniques for more efficient use of the air jet header and the proprietary designs being developed by commercial firms to compete with it, and also toward achievement of those other objectives of the program that were postponed during the first years.

2. Fire and Smolder Retardant Cotton Products. Research initiated by the Southern Regional Research Center in 1964 toward improving the flame and smolder retardancy properties of cotton fabrics and cotton batting resulted in 13 documented cases of lives saved in 1973 from the use of flame retardant sleepwear in children's size 0-6X and in mattresses. The economic losses prevented by the saving of these 13 lives (12 from sleepwear fires and one from a mattress fire) amount to over $6 million. The present value of the savings and lifetime salaries involved, when discounted at 7 percent back to 1973, the year of the fires amounts to $2.1 million. If this and other benefits made possible by this research should be attributed wholly to research, the benefit to cost ratio would be 6:1.

The present value of $2.1 million for the 13 lives saved is based on conservative estimates of medical and hospital costs and assumes a lifetime income per person of $487,873 below 18 years of age and $239,437 above that. However, nothing can replace or compensate for the loss of human lives. Other benefits to society in 1973 resulted from this research. One is the net value added to GNP by the production of fire retardant chemicals ($11.7 million), and by the installation of cotton batting machinery ($1.2 million). A second is in the value of cotton sold to textile processors ($0.9 million) and bedding manufacturers ($1.9 million) in contributing to the support of rural area activities for farmers, assuming a 100 percent loss of market if cotton materials could not meet Federal flame retardance standards.

The total cost of R&D effort to 1973 at 7 percent interest compounded annually is $6.8 million and a similar cost for dissemination of the technology is $1.5 million. It is estimated that industry, foundations, and other government agencies spent $25 million for related research during the time period under study and that about one-fifth of this is directly related to flame retardancy in cotton. This would approximately double the annual research cost, thus the total research expediture as of 1973 would be $13.6 million.

The ratio of the total of the three kinds of benefits, discounted to 1973, to the total of costs to 1973 is 6:1. The calculations leading to this ratio are considered conservative in that they ignore some value added in the chemical industry in earlier years, do not take into account benefits from treating other fabrics such as tents and draperies, ignore the probable further benefits from extending the fire retardant process to other size sleepwear and to still other apparel, etc. In particular, they make no assumption about the very probable event of preventing even more fires in size 0-6X sleepwear and mattresses in the future years than in 1973. The potential for benefits in 1973 from these two sources was estimated to have been $52 million had it been fully realized.

In addition to achieving its broad social goals, the flame retardancy research established an enviable record of achievement in publications and patents produced. Over the period 1964 to 1973 this work produced 146 technical publications and 54 patents issued with 23 others applied for and still pending at that time. Additionally, many technical accomplishments representing synthesis and development of fire retardant compounds and processes were completed—including 10 commercialized products. These undoubtedly have had substantial further impact on development by industry and in other areas benefiting society.

Research continues on new methods of measuring flame retardance, identifying combustion products of flame retardant cotton-based textiles, on new and more efficient chemical systems for increasing the fire retardance of cotton and cotton-synthetic blends, and on engineering specifications for the THPOH-NH3 and methyl borate vapor phase processes for improving the fire retardancy of cotton textiles and cotton batting, respectively.

3. Control of Marek's Disease in Chickens. ARS increased research emphasis on Marek's disease of chickens in 1965. This led to the development and full adoption by 1974 of a vaccine that successfully controls the disease. The cost to ARS of this achievement was about $8.5 million at the USDA Regional Poultry Research Laboratory (RPRL) at East Lansing, Michigan, for research on, primarily, Marek's disease. It was matched by an approximately equal amount from other public institutions interested in research on Marek's disease and lymphoid leukosis, but primarily on lymphoid leukosis. The total of this public sector support is estimated to have been matched by research funds in the private sector, thus the total is estimated to be $32 million. There is, also, a laboratory in England comparable to the RPRL working on the avian leukosis problem.

The savings and increased production made possible by this vaccine by 1974 were sufficient to represent a return of 83 percent compounded annually on the total research investment, public and private, on this problem and its related disease, lymphoid leukosis, over the 10-year period from 1965 to 1974. If it is assumed that the benefits of $168 million experienced in 1974 from Marek's disease alone will continue for another 10 years before replacement by some other technology, and that the total of all research efforts will continue at the 1974 level of $4.3 million, the total estimated returns made possible by this research by 1984 would be sufficient to support a return of 88 percent compounded annually on the

total invested in this research over the 20-year period. Neither of these estimates assume credit for benefits other than Marek's disease control.

If both costs and benefits are discounted at a reasonable cost-of-capital rate of 7 percent annually to 1965, the ratio of benefits to costs is 22:1. Even if costs from the beginning of the laboratory in 1939 to 1965 should be considered (The ARS part was less than $6 million.), and even if only the benefits from the Marek's disease vaccine as delineated here are considered, and even if the total cost over the entire period was four times the ARS cost as in recent years, the operation would still be highly profitable—the benefit to cost ratio is still about 4:1 even when discounted at 7 percent to 1939.

Although the ARS financial contribution to this research was only about one-fourth of the U.S. total, most of the major discoveries in this country relative to the Marek's disease vaccine were made by ARS scientists and the Marek's disease vaccine is widely regarded as primarily an ARS achievement. The vaccine made possible the control of this disease on a world wide basis. However, on the assumption that benefits are distributed globally in proportion to global costs, both benefits and costs in this study are reported for the United States only.

Given this outstanding technological breakthrough on a highly complex and difficult research area, a brief description of the historical setting of the RPRL is provided.

The Regional Laboratory was completed in 1939. It was constructed under the Bankhead-Jones Act to conduct research cooperatively with State Agricultural Experiment Stations on the mortality of laying chickens, a problem that had become of increasing importance during the period from 1925 to 1937, a time of very rapid development in the commercial poultry industry.

The research program initiated at the Regional Laboratory soon led to identification of the "avian leukosis complex" as the major cause of the mortality. Through the 1940's and 1950's work continued on the "avian leukosis complex," which included neural, visceral, and ocular lymphomatosis, and was thought to be caused by a single group of viruses. Later work, conducted largely by the Laboratory, showed the complex to be three virus diseases: lymphoid leukosis, Marek's disease, and reticuloendotheliosis. (The last is relatively unimportant).

Until about 1960 the research was directed mainly at lymphoid leukosis. During this period over 200 papers were published contributing to knowledge in the fields of genetics, pathology and poultry nutrition and management. Over one-fourth of these papers were judged to be reporting significant or highly significant discoveries on lymphoid leukosis. There was by 1960, however, still no practical control of the "leukosis complex" in poultry.

By 1961, Marek's disease had been generally recognized as a separate and distinct disease from lymphoid leukosis. During the next few years, there was an apparent increase in its incidence. In the light of this new knowledge about the disease complex and the increasing importance of the Marek's disease component, research emphasis at the Regional Poultry Research Laboratory was shifted in 1965 to Marek's disease. Significant discoveries and developments, though often chronologically dependent, flowed in a rapid stream from the Laboratory with: isolation of the causative virus by 1967; discovery of the transmission mechanism by 1969; isolation of the herpesvirus of turkeys (HVT) and laboratory demonstration of its ability to protect against Marek's disease, both in 1969; field trials of HVT vaccine in 1970, licensing by State for use in Michigan in late 1970, and by the USDA Animal and Plant Health Inspection Service for national use in early 1971. Adoption was judged to be complete (95 percent) in 1974.

The benefits from Marek's disease research are undoubtedly larger than was expected at the inception of the research program. In fact the use of the vaccine soon resulted in an over-production of poultry meat and eggs which, in turn resulted in a severe drop in prices. However, supply and demand have since stabilized and the benefits are now spread to the population at large in the form of a decrease in the cost of production of each broiler and each dozen eggs. As a result, consumers can purchase poultry products at less cost than they could have without these discoveries. Individual producers in the industry may or may not have benefited in the short-run, depending on how rapidly they adopted the new technology. After the short-run economic adjustment problems were overcome, the poultry industry as a whole, however, gained long-run benefits in terms of its competitive position vis-a-vis other foods. Also, the nation has benefited because fewer resources are necessary to produce the same number of broilers and eggs as were produced before the discoveries, with attendant conservation of natural resources and availability of additional human resources for other uses.

In addition to the above tangible benefits, there are many intangible benefits. One is the more predictable and efficient growth of chickens. Another is the impact of this research upon other scientists in various fields, and particularly, in human cancer research.

For example, Marek's disease was and still is the first cancer in man or animal shown to be caused by this type of virus and was and still is the first cancer-like tumor condition in man or animal to be controlled by a commercially applicable vaccine.

Research continues on possible improvement of the protection from Marek's disease, particularly with respect to the problem that vaccinated chickens are frequently latent carriers of the potentially tumor-forming field and vaccine virus persisting in the live bird and carcass after vaccination. Research is also being redirected to the lymphoid leukosis problem with the objective of reducing losses from this disease by treatment and eventual eradication.

Status of Construction Projects as of December 1976

Status of research facilities authorized in prior years, and reported as uncompleted in the 1977 Explanatory Notes, is as follows:

NOTE: (Design criteria provided by ARS to specify the program requirements and form the basis for negotiation of architect-engineer contracts. Diagrammatic drawings provide the basis for the first review of the architect's design. Tentative drawings are provided by the architect for firming up cost estimates and a basis for developing the completed, and final working drawings.)

Location and Purpose	Funds Provided Year	Amount	
California, Albany			
Wool utilization research	1968 Plans	$ 50,000 a/	Final working drawings completed May 1970.
California, Riverside			
Soil and water conservation research	1968 Plans	50,000 a/	Final working drawings completed July 1970.
Colorado, Akron			
Soil and water conservation research	1970 Plans	50,000 b/	Final working drawings completed June 1973
	1973 Construction ..	750,000	Construction contract awarded December 1974
	1976 Redirection ...	100,000 c/	Construction expected to be completed in
	Total	900,000	the third quarter fiscal year 1977.
District of Columbia; Washington			
National Arboretum	1976 Land Acquisition and site preparation	5,985,000	Acquisition of land completed September 1976. Contract for site rehabilitation and temporary road awarded September 1976. Construction expected to be completed in the fourth quarter fiscal year 1977.
Louisiana, Baton Rouge			
Soil and water conservation research	1971 Plans	80,000	Criteria being revised to meet new program requirements.
Maryland, Beltsville			
Sewage treatment facilities	1975 Construction ..	1,400,000 d/	Construction contract for the East Waste
	1976 Construction ..	2,350,000	Water Treatment Plant awarded January 1976.
	Total	3,750,000 e/	Construction contract for the West Plant awarded September 1976. Construction

Status of Construction Projects as of December 1976 - Cont.

Location and Purpose	Funds Provided Year	Amount	
Maryland, Beltsville - Cont.			expected to be completed on both projects in the third and fourth quarter of 1977 respectively. Construction contract for the sewer and water lines awarded September 1976. Construction expected to be completed in the fourth quarter fiscal year 1977.
Nebraska, Clay Center Meat animal research (Phase II)	1968 Plans	$ 250,000	Construction contract awarded October 1975. Construction expected to be completed in the first quarter of fiscal year 1978. Contract awarded in September 1976 for entire $1,200,000 made available in FY 1976.
	1975 Construction ..	5,020,000	
	1976 Construction ..	1,200,000	
	Total	6,470,000	
New York, Ithaca Soil and water conservation research	1968 Plans	40,000 a/	Due to cost escalation, funds for the Ithaca, New York project have been redirected to Beckley, West Virginia to provide sufficient funds to construct the facility.
	1976 Redirection ...	-40,000 f/	
	Total	- -	
New York, Plum Island Additional animal and laboratory facilities	1973 Plans	250,000	Construction contract awarded September 1976. Construction expected to be completed in the fourth quarter of fiscal year 1978.
	1976 Construction ..	10,000,000	
	1977 Redirection ...	650,000 g/	
	Total.....	10,900,000	
New York, Plum Island Air pollution abatement and sewage facilities	1973 Plans and construction .	1,060,000 d/	Construction contract for incinerator modification in Building #257 completed in third quarter of fiscal year 1976. Construction contract for incinerator modification in Building #101 incinerator B awarded September 1976, and construction is expected to be completed in the first quarter of fiscal year 1979. AE contract for incinerator A has been awarded and design is expected to be completed in the third quarter fiscal year 1977.
	1976 Construction ..	2,600,000	
	1977 Redirection ...	-550,000 g/	
	Total	3,110,000	

Status of Construction Projects as of December 1976 - Cont.

Location and Purpose	Funds Provided Year	Amount	
New York, Plum Island - Cont.			The sewage treatment facilities construction contract was awarded April 1976, and ia expected to be completed in the third quarter of fiscal year 1977.
North Dakota, Grand Forks			
Human nutrition research	1976 Plan	$ 225,000	Design criteria being prepared. AE contract award expected in the third quarter fiscal year 1977.
Texas, Temple			
Grassland and forages research	1968 Plans	150,000	Initial construction completed in February 1974. Additional construction contract awarded May 1976, and construction ia expected to be completed in the second quarter of fiscal year 1977.
	1971 Construction .	1,500,000	
	1973 Conatruction .	500,000	
	Total	2,150,000	
West Virginia, Beckley			
Soil and water conservation research	1972 Plans	70,000	Project being redesigned for a complete facility. Design expected to be completed in the third quarter of fiacal year 1977.
	1973 Conatruction .	700,000	
	1976 Redirection ..	40,000 f/	
	Total.....	810,000	
West Virginia, Kearneysville			
Fruit Crop Research	1973 Plans	200,000	Construction contract for lab-office and farm compound buildings awarded in first quarter of fiscal year 1977. Construction is expected to be completed in the second quarter of fiscal year 1978.
	1976 Construction .	7,570,000	
	Total.....	7,770,000	

Status of Construction Projects as of December 1976 - Cont.

Footnotes:

a/ Funds provided from the Contingency Research Fund.

b/ Since $50,000 appropriated in 1970 for planning a Soil-Water-Plant Research Laboratory, Ithaca, New York, and Soil and Water Laboratory, Akron, Colorado, was insufficient to plan both of these facilities, the full amount was used at Akron, Colorado.

c/ Due to cost escalation, an additional $100,000 has been reprogrammed from unspent balances of completed construction projects for construction of the Akron, Colorado, facility.

d/ Planning funds were not appropriated separately, but are included in the funds appropriated for construction.

e/ In addition, the Department of Treasury will provide $100,000 toward costs incurred in completing the project.

f/ Due to cost escalation, funds for the Ithaca, New York, project have been redirected to Beckley, West Virginia, to provide sufficient funds to construct the facility.

g/ Due to the inclusion of some pollution abatement facilities in the animal and laboratory project, which would otherwise have been constructed separately, funds were redirected from the air pollution abatement and sewage treatment project to provide funds for the complete facility as originally planned and designed for the animal and laboratory project. In addition, $100,000 has been redirected into the Plum Island animal and laboratory project from regular program funding.

CONTINGENCY RESEARCH FUND

The Contingency Research Fund, established by Congress in fiscal year 1962, is designed to provide a ready source of funds to meet unforeseen and immediate research needs. Releases from the fund are generally made in situations where an emergency exists, or for special needs such as an unexpected scientific "breakthrough," or for new diseases or pest problems where it appears inadvisable to wait for consideration of a request for funds for the project in the regular budget process. In allocating funds, the procedure ordinarily is to make no commitments for allocations from the fund beyond the current year.

In fiscal year 1976, releases from the Contingency Research Fund were made for the following purposes:

	1976 Obligations
Animal Production Efficiency Research:	
American form of malignant catarrhal fever: cause, transmission and pathogenesis	30,000
Artificial insemination of broiler breeders	60,000
Determine phosphorus levels necessary for reproduction in beef cattle	35,300
Biological control of bovine brucellosis by stimulation of cell-mediated immunity	76,361
Eradication of horn flies, Haematobia irritana, from Molokai, Hawaii	25,000
Field testing of coyote repellent	14,524
Pathogenesis, epidemiology, and control of pseudorabies	50,000
Research to determine sources of infection and potential methods of controlling ornithosis outbreaks in turkeys	40,000
Control of Alfombrilla, a Mexican broad-leaf flowering plant highly toxic to livestock	2,442
Crop Production Efficiency Research:	
Control of Alfombrilla, a Mexican broad-leaf flowering plant highly toxic to livestock	9,962
Bacterial blight of wheat-epidemiology etiology, and genetic resistance	5,500
Develop methods for control of the peach tree borer and the lesser peach tree borer	43,234
Implementation of management program for cotton insects utilizing Heliothis and plant bug resistant varieties	25,661
Large-scale field evaluation of insect growth regulators for control of imported fire ants	7,948
Research to prevent Mediterranean fruit fly from entering Mexico and U.S.A.	75,862
Screen ARS basic collection of pea accessions for presence of pea seed-borne mosaic virus	12,295

	1976 Obligations
Effects of increased ultraviolet radiation on agricultural production	53,966
Effect of resistant corn on the biology of the Southwestern corn borer	5,362
Increase wheat yield with fungicide growth regulator combination	8,000
Development and implementation of the organic solvent infusion method to treat seeds with minimal amounts of fungicides to control soilborne plant pathogens	25,000
Expansion of research on citrus black fly in support of Federal State control program	58,208
Identification of Heliothis zea sex pheromone	5,711
Research on DDT & substitute chemicals for control of Heliothis on cotton	23,261
Propagation of elm clones resistant to Dutch elm disease	6,508
Determine extent of insecticide resistance and identify sex pheromone(s) in corn rootworm	24,058
Research on Conservation and Use of Land and Water Resources and Maintaining Environmental Quality:	
Research on DDT and substitute chemicals for control of Heliothis on cotton	13,534
Develop methods to estimate soil/water content, evapotranspiration, and crop yields using thermal parameters	29,539
Research on Watershed Development:	
Research on DDT and substitute chemicals for control of Heliothis on cotton	4,902
Processing, Storage and Distribution Efficiency Research:	
Verification of the formation of cholesterol a-oxide during heat processing of egg liquids	49,872
Feasibility study for using solar energy to dry corn	10,023
Controlling tobacco insects on farm-stored tobacco	10,000
Determination of beef carcass quality	8,517
Research to Improve Human Health and Safety:	
Identification of Heliothis zea sex pheromone	7,605
Development of processing, storage and handling facilities for inactivation of mycotoxins in cereal grains by chemical treatment	40,525

	1976 Obligations
Food and Nutrition Research:	
Survey of home-canning practices	24,300
Total, 1976 Obligations	922,980
Unobligated balance	77,020
Total available 1976 Contingency Research Fund	1,000,000

Current Activities. As of December 1976, a total of $289,500 has been approved for release from the Contingency Research Fund in FY 1977.

	1977 Estimated Obligations
Animal Production Efficiency Research:	
Development of Swormlure-2 for screwworm control and suppression	$ 50,000
Determine presence of bluetongue virus in reproductive organs of cattle	25,000
Crop Production Efficiency Research:	
Development of new control technology for citrus blackfly	90,000
Heliothis zea sex pheromone research	24,500
Intensified research to develop pratical applications for Japanese beetle synthetic female sex pheromone	15,000
Research on Conservation and Use of Land and Water Resources and Maintaining Environmental Quality:	
Evaluate safety and environmental effects of Dimilin insecticide	35,000
Research to Improve Human Health and Safety:	
Toxicity studies on ammoniated aflatoxin-contaminated corn in laying hens	50,000
Total, 1977 approved for release from the Contingency Research Fund	289,500
Balance to be allocated prior to September 30, 1977	710,500
Total available, 1977 Contingency Research Fund	$1,000,000

STATEMENT OF OBLIGATIONS AND MAN-YEARS

BY LOCATION

Location	Actual 1976		Estimated 1977		Estimated 1978	
	Dollars	Man-Years	Dollars	Man-Years	Dollars	Man-Years
ALABAMA, Auburn	$1,403,818	58	$1,663,500	61	$1,611,800	61
ALASKA, Palmer	448,180	9	482,600	9	482,900	9
ARIZONA						
Flagstaff	143,143	6	93,100	4	93,200	4
Mesa	164,252	7	169,800	7	- -	- -
Phoenix	2,701,970	110	2,753,700	116	2,815,200	118
Tucson	2,097,080	87	2,236,800	87	2,311,800	88
Total	5,106,445	210	5,253,400	214	5,220,200	210
ARKANSAS, Stuttgart	182,226	2	150,900	2	151,200	2
CALIFORNIA						
Albany	11,646,530	423	12,673,700	444	12,784,900	444
Brawley	686,011	32	736,300	31	737,900	31
Davis	458,509	14	610,800	17	611,200	17
Fresno	1,614,304	58	1,701,600	61	1,672,300	61
Indio	214,308	11	239,900	12	230,000	12
Pasadena	490,749	16	533,600	16	503,900	16
Riverside	1,710,653	60	1,946,800	64	1,952,200	67
Salinas	716,572	32	793,100	33	783,100	33
Shafter	613,170	24	559,200	20	560,200	20
Total	18,150,806	670	19,795,000	698	19,835,700	701
COLORADO						
Akron	258,035	9	215,100	9	210,500	9
Denver	1,146,791	41	1,185,100	44	1,188,000	44
Fort Collins	2,283,396	86	2,574,700	100	2,548,900	100
Total	3,688,222	136	3,974,900	153	3,947,400	153
DISTRICT OF COLUMBIA						
Program	1,511,157	76	1,608,900	89	1,587,400	89
Headquarters						
Agency Management Services.	19,876,293	551	22,076,500	542	22,632,800	542
Centrally Financed Programs	1,472,501	5	11,417.300	5	14,105,100	5
Repairs and Maintenance	- -	- -	- -	- -	7,216,000	- -
Subtotal	21,348,794	556	33,493,800	547	43,953,900	547
Total	22,859,951	632	35,102,700	636	45,541,300	636
DELAWARE						
Georgetown	234,776	8	263,100	10	257,300	10
Newark	266,621	12	293,800	12	294,100	12
Total	501,397	20	556,900	22	551,400	22
FLORIDA						
Belle Glade	139,773	5	150,400	6	151,700	6
Bradenton	43,061	1	39,000	1	39,100	1
Brooksville	176,916	3	149,500	3	141,900	3
Canal Point	337,913	17	433,300	15	346,500	15
Fort Lauderdale	70,309	2	103,400	3	103,500	3
Gainesville	3,689,539	130	4,436,700	139	4,455,900	139
Lake Alfred	96,626	4	102,400	5	102,500	5

STATEMENT OF OBLIGATIONS AND MAN-YEARS

BY LOCATION

Location	Actual 1976		Estimated 1977		Estimated 1978	
	Dollars	Man-Years	Dollars	Man-Years	Dollars	Man-Years
FLORIDA (continued)						
Miami	$553,288	25	$666,100	27	$791,900	27
Orlando	1,765,192	71	1,862,300	67	1,950,100	67
Winter Haven	571,837	24	585,400	23	574,800	23
Total	7,444,454	282	8,528,500	289	8,657,900	289
GEORGIA						
Athens	5,526,329	226	5,876,600	262	6,043,500	262
Byron	1,240,496	58	1,319,500	62	1,522,300	62
Dawson	484,383	24	520,700	23	519,900	23
Experiment	210,318	5	228,200	6	228,400	6
Savannah	1,565,634	72	1,799,800	76	1,793,400	76
Tifton	2,623,013	105	2,816,400	100	3,110,700	100
Watkinsville	814,524	33	1,017,300	38	1,080,400	38
Total	12,464,697	523	13,578,500	567	14,298,600	567
HAWAII						
Hilo	236,184	10	245,500	5	246,600	5
Honolulu	777,949	28	994,300	26	994,800	26
Total	1,014,133	38	1,239,800	31	1,241,400	31
IDAHO						
Aberdeen	212,054	5	277,300	7	277,500	7
Boise	425,888	19	486,500	19	490,900	19
Dubois	673,379	16	729,700	20	738,000	20
Kimberly (Twin Falls)	1,106,046	49	1,250,300	50	1,260,300	50
Total	2,417,367	89	2,743,800	96	2,766,700	96
ILLINOIS						
Chicago	136,995	4	139,600	4	139,700	4
Peoria	12,036,503	465	12,292,000	455	12,117,000	455
Urbana	1,305,686	41	1,370,900	46	1,357,000	46
Total	13,479,184	510	13,802,500	505	13,613,700	505
INDIANA						
Lafayette	1,126,277	33	1,412,800	37	1,410,100	37
Vincennes	195,997	8	214,100	8	209,300	8
Total	1,322,274	41	1,626,900	45	1,619,400	45
IOWA						
Ames	7,445,049	296	8,395,800	304	8,360,300	304
Ankeny	302,525	10	332,500	8	332,900	8
Total	7,747,574	306	8,728,300	312	8,693,200	312
KANSAS, Manhattan	2,090,246	72	2,503,500	71	2,564,400	71
KENTUCKY, Lexington	609,292	28	646,400	28	723,600	28
LOUISIANA						
Baton Rouge	1,058,368	38	1,125,400	47	1,118,800	47
Crowley	67,224	2	48,400	2	48,500	2
Houma	680,105	28	725,600	32	722,700	32
Jeanerette	113,254	4	147,300	4	119,500	4

STATEMENT OF OBLIGATIONS AND MAN-YEARS

BY LOCATION

Location	Actual 1976		Estimated 1977		Estimated 1978	
	Dollars	Man-Years	Dollars	Man-Years	Dollars	Man-Years
LOUISIANA (continued)						
Lake Charles	$183,987	7	$254,900	7	$196,200	7
New Orleans	13,286,262	479	12,989,000	500	13,086,600	500
Total	15,389,200	558	15,290,600	592	15,292,300	592
MAINE, Orono	426,317	14	407,300	17	407,500	17
MARYLAND						
Beltsville	39,329,532	1,620	44,242,100	1,723	44,862,800	1,723
Frederick	1,188,300	39	1,412,100	41	1,401,200	41
Glenn Dale	240,158	12	324,700	12	264,700	12
Hyattsville	1,587,060	76	4,706,000	89	4,708,200	89
Total	42,345,050	1,747	50,684,900	1,865	51,236,900	1,865
MICHIGAN, East Lansing	1,627,292	66	1,912,700	72	1,866,800	72
MINNESOTA						
East Grand Forks	286,212	9	306,800	10	290,300	10
Minneapolis	115,168	4	132,500	4	132,600	4
Morris	789,954	37	856,000	38	833,000	38
St. Paul	1,015,545	31	1,215,700	38	1,386,300	38
Total	2,206,879	81	2,511,000	90	2,642,200	90
MISSISSIPPI						
Gulfport	156,641	7	248,500	8	248,800	8
Meridian	213,835	11	307,600	11	307,800	11
Oxford	1,379,479	58	1,429,100	59	1,393,600	59
Poplarville	80,998	3	85,000	3	73,100	3
Mississippi State	2,817,107	94	2,989,400	107	3,052,300	107
Stoneville	3,780,242	180	4,036,800	157	4,011,600	157
Total	8,428,302	353	9,096,400	345	9,087,200	345
MISSOURI, Columbia	2,414,461	93	2,642,700	96	2,724,900	96
MONTANA						
Bozeman	509,000	16	485,800	17	528,600	17
Miles City	552,338	9	893,800	11	744,600	11
Sidney	616,470	25	682,200	28	677,800	28
Total	1,677,808	50	2,061,800	56	1,951,000	56
NEBRASKA						
Clay Center	4,541,737	48	5,164,900	64	5,089,300	64
Lincoln	1,013,417	33	1,054,000	32	1,055,000	32
Total	5,555,154	81	6,218,900	96	6,144,300	96
NEVADA, Reno	303,540	11	445,900	12	467,400	12
NEW JERSEY, New Brunswick	239,638	8	359,700	10	360,000	10
NEW MEXICO						
Albuquerque	214,529	8	219,600	8	- -	- -
Las Cruces	825,922	27	821,500	32	820,200	32
Total	1,040,451	35	1,041,100	40	820,200	32

STATEMENT OF OBLIGATIONS AND MAN-YEARS

BY LOCATION

Location	Actual 1976		Estimated 1977		Estimated 1978	
	Dollars	Man-Years	Dollars	Man-Years	Dollars	Man-Years
NEW YORK						
Geneva	122,140	4	157,200	6	157,300	6
Ithaca	1,416,815	45	1,750,600	44	1,657,200	44
Plum Island	7,535,918	323	8,969,400	346	8,746,900	346
Total	9,074,873	372	10,877,200	396	10,561,400	396
NORTH CAROLINA						
Oxford	828,943	38	904,900	35	871,700	35
Raleigh	1,562,252	51	2,089,200	56	2,258,800	56
Total	2,391,195	89	2,994,100	91	3,130,500	91
NORTH DAKOTA						
Fargo	3,303,096	122	3,618,900	123	3,695,500	123
Grand Forks	1,375,012	23	1,390,900	38	1,396,600	38
Mandan	1,149,881	46	1,468,600	48	1,432,800	48
Total	5,827,989	191	6,478,400	209	6,524,900	209
OHIO						
Columbus	- -	- -	162,300	4	162,400	4
Coshocton	562,170	18	493,200	18	468,200	18
Delaware	479,013	14	394,400	15	395,600	15
Wooster	761,328	33	820,500	33	818,700	33
Total	1,802,511	65	1,870,400	70	1,844,900	70
OKLAHOMA						
Chickasha	639,578	37	742,300	37	742,900	37
Durant	546,303	23	566,100	21	566,700	21
El Reno	351,115	5	327,400	7	291,600	7
Stillwater	527,470	18	738,400	22	824,000	22
Woodward	295,439	15	327,200	16	323,600	16
Total	2,359,905	98	2,701,400	103	2,748,800	103
OREGON						
Burns	74,760	2	75,500	2	75,600	2
Corvallis	1,091,651	38	1,139,900	42	1,360,900	42
Pendleton	492,545	11	546,200	21	546,400	21
Total	1,658,956	51	1,761,600	65	1,982,900	65
PENNSYLVANIA						
University Park	1,271,546	51	1,365,500	50	1,528,000	50
Wyndmoor	8,463,269	335	8,339,100	340	8,276,500	340
Total	9,734,815	386	9,704,600	390	9,804,500	390
SOUTH CAROLINA						
Charleston	708,291	36	787,000	35	787,100	35
Clemson	1,098,499	35	1,041,300	38	1,049,300	38
Florence	794,087	31	805,900	34	821,300	34
Total	2,600,877	102	2,634,200	107	2,657,700	107
SOUTH DAKOTA, Brookings-Madison	829,958	37	936,100	36	938,800	36

STATEMENT OF OBLIGATIONS AND MAN-YEARS

BY LOCATION

Location	Actual 1976		Estimated 1977		Estimated 1978	
	Dollars	Man-Years	Dollars	Man-Years	Dollars	Man-Years
TENNESSEE						
Jackson	$75,672	3	$94,900	4	$95,900	
Greenville	132,620	5	136,000	7	136,200	
Knoxville	755,089	26	775,400	29	777,600	
Lewisburg	84,284	4	87,200	4	87,300	
Total	1,047,665	38	1,093,500	44	1,097,000	
TEXAS						
Beaumont	268,522	12	373,300	12	375,200	
Big Spring	105,895	4	164,800	5	156,200	
Brownsville	1,050,232	52	1,183,400	45	1,124,300	
Brownwood	245,969	9	301,300	12	303,000	
Bushland	875,256	31	1,037,200	38	1,044,600	
College Station	3,940,526	170	4,227,600	147	4,228,200	1
El Paso	49,740	2	47,800	2	47,900	
Kerrville	1,216,914	58	1,492,300	52	1,699,000	
Lubbock	622,386	25	659,900	25	668,400	
Mission	663,685	19	686,600	17	688,100	
Temple	1,074,971	25	1,481,300	46	1,464,000	
Vernon (Chillicothe)	109,839	4	58,500	3	58,600	
Weslaco	2,160,313	99	2,487,600	95	2,496,000	
Total	12,384,248	510	14,201,600	499	14,353,500	
UTAH, Logan	1,462,512	52	1,660,800	56	1,670,400	
VIRGINIA						
Blacksburg	97,326	3	103,600	4	103,700	
Richmond	131,288	5	144,300	5	144,400	
Suffolk (Holland)	291,385	12	322,300	13	323,900	
Total	519,999	20	570,200	22	572,000	
WASHINGTON						
Prosser	845,036	35	907,400	37	965,800	
Pullman	1,474,890	58	1,773,800	67	1,777,300	
Puyallup	1,747	- -	- -	- -	- -	
Wenatchee	539,461	21	582,100	21	582,500	
Yakima	1,085,529	47	1,109,000	45	1,109,800	
Total	3,946,663	161	4,372,300	170	4,435,400	
WEST VIRGINIA, Morgantown	363,638	10	395,300	16	395,700	
WISCONSIN, Madison	1,280,825	42	1,321,600	44	1,337,400	
WYOMING						
Cheyenne	370,245	13	395,100	16	453,500	
Laramie	218,795	7	295,400	11	295,600	
Total	589,040	20	690,500	27	749,100	
PUERTO RICO						
Mayaguez	615,415	38	752,400	39	904,600	
Rio Piedras	229,233	7	298,300	9	299,700	
Total	844,648	45	1,050,700	48	1,204,300	
VIRGIN ISLANDS, St. Croix	177,949	12	202,200	10	195,600	

STATEMENT OF OBLIGATIONS AND MAN-YEARS

BY LOCATION

Location	Actual 1976		Estimated 1977		Estimated 1978	
	Dollars	Man-Years	Dollars	Man-Years	Dollars	Man-Years
OTHER COUNTRIES						
Argentina	$7,595	- -	$54,100	- -	$54,100	- -
El Salvador	177,463	2	178,900	2	179,000	2
France, Paris	212,949	6	219,600	9	219,700	9
Italy, Rome	133,946	5	106,100	4	106,200	4
Kenya	63,065	2	99,700	2	99,800	2
Netherlands, Rotterdam	214,028	4	239,700	5	239,800	5
Pakistan	56,150	1	55,200	2	55,200	2
Thailand	55,311	1	62,900	2	62,900	2
Total	920,507	21	1,016,200	26	1,016,700	26
Construction of Facilities	29,930,000	- -	450,000	- -	- -	- -
Contingency Research Fund	a/	- -	1,000,000	- -	1,000,000	- -
Competitive Grant Research Fund	- -	- -	- -	- -	27,000,000	- -
Unobligated Balance	9,977,957	- -	- -	- -	- -	- -
Subtotal, Available or Estim.	282,311,088	9,045	281,034,000	9,459	319,743,000	9,459
Allotment to:						
Forest Service	527,912	15	555,000	15	376,000	10
Cooperative State Research Service	- -	- -	- -	- -	600,000	15
Total, Available or Estimated	282,839,000	9,060	281,589,000	9,474	320,719,000	9,484

a/ Obligations of $922,980 of the $1,000,000 appropriated in 1976 are included in the projects above.

Scientific Activities Overseas (Special Foreign Currency Program)

Appropriation Act, 1977	$7,500,000
Budget Estimate, 1978	7,500,000

PROJECT STATEMENT
(on basis of appropriation)

Project	1976 Actual	1977 Estimate	Increase or Decrease	1978 Estimate
1. Market development research, Sec. 104(b)(1)	$1,000,000	$1,000,000	$ - -	$1,000,000
2. Agricultural and forestry research Sec. 104(b)(3)	5,850,000	5,700,000	-150,000	5,550,000
3. Translation and dissemination of scientific publications, Sec. 104(b)(3)	650,000	800,000	+150,000	950,000
Total, appropriation	7,500,000	7,500,000	- -	7,500,000

The following statement reflects carryover into succeeding years of actual or estimated prior year balances and shows total actual or planned obligations.

PROJECT STATEMENT
(on basis of available funds)

Project	1976 Actual	1977 Estimate	Increase or Decrease	1978 Estimate
1. Market development research, Sec. 104(b)(1)	$ 324,841	$1,000,000	$ - -	$1,000,000
2. Agricultural and forestry research, Sec. 104(b)(3)	6,431,597	6,702,930	-1,152,930	5,550,000
3. Translation and dissemination of scientific publications Sec. 104(b)(3)	300,000	1,201,702	-251.702	950,000
Total, obligations	7,056,438	8,904,632	-1,404,632	7,500,000
Unobligated balance, start of year	-1,426,010	-1,404,632	+1,404,632	- -
Unobligated balance, end of year	+1,869,572	- -	- -	- -
Total, available or estimate	7,500,000	7,500,000	- -	7,500,000

EXPLANATION OF PROGRAM

Foreign currencies which the Treasury Department determines to be excess to the normal requirements of the United States are used for expenses of carrying out programs of the Department of Agriculture as authorized by law and described under sections 104(b) (1) and 104(b) (3) of the Agricultural Trade Development and Assistance Act of 1954, as amended. Research is carried on through agreements negotiated with research institutions and organizations in foreign countries. Countries currently participating in this program are Egypt, India, Pakistan, and Tunisia. The research must be of importance to American agriculture. It serves to preserve and expand existing markets and develop new ones for agricultural commodities. It provides for research supplementary to domestic programs on problems of farm, marketing, utilization, agricultural economics and human nutrition, and makes possible the conduct of research on exotic insect pests and diseases of plants and animals which could not be done in the United States. Specialized projects provide for the translation and dissemination of foreign language scientific publications.

STATUS OF THE SPECIAL FOREIGN CURRENCY RESEARCH PROGRAM (SFCRP)

In Fiscal year 1958, the Department initiated a research grant program abroad utilizing foreign currencies from the sale of surplus agricultural commodities under Title I of Public Law 480. Originally confined to market development research authorized by Section 104(b) (1) of P.L. 480, as amended, the program was subsequently expanded to include agricultural and forestry research under Section 104(b) (3) of the law, as amended. In fiscal year 1966, the authorization changed to permit the use of all excess currencies for work performed under the Special Foreign Currency Program. Activities sponsored fall into the following general areas:

1. Agricultural research, including research on plant and animal production; use and improvement of soil, water and air; and research on marketing, use and effects of agricultural products.

2. Forestry research, including research on the protection of forests from fires, diseases and insects; on methods and procedures for increasing the growth of managed forests, and on properties and uses of forest products.

3. Agricultural economics research, including farm and market economics research and foreign trade analysis.

Dollar-financed research in these areas is conducted by the Agricultural Research Service, the Forest Service, and the Economic Research Service in their respective areas of functional and subject-matter responsibilities. Research under this program is designed to complement and not to duplicate or displace the dollar-financed research activities of these agencies.

Within the Department, primary responsibility for administration of this program is assigned to the Agricultural Research Service. The activities are coordinated with operations in the Forest Service, Economic Research Service, and the Foreign Agricultural Service by the Director, International Programs Division, ARS. The Director coordinates development of broad policies for operations of the program and coordinates the activities of the various Department agencies in carrying out research financed by foreign currencies. Initial arrangements and budget clearances for the research in foreign countries are made through the Department of State as required by Executive Order 10900, Section 3(b) and (c), and through the Agricultural Attaches of the Foreign Agricultural Service of the Department.

Prior to executing any research agreement with a foreign institution, the Department again consults with the Agricultural Attaches and Heads of Missions to insure that the proposed projects would be consonant with the foreign policy of the United States.

Care is exercised to make certain that research projects undertaken benefit American agriculture and do not develop undesirable competition for American agricultural products abroad. Careful attention is given to the type of institution conducting research under this program to make certain it has the facilities, equipment, and personnel to carry out sound and productive research. Because of these high standards, about 58 percent of the proposals received from foreign institutions have been rejected by the Department; 41 percent of the proposals have been accepted, and the agreements have been executed or are awaiting execution. Final determination has not yet been made on acceptance or rejection of the remaining 1 percent.

U.S. research priorities, as well as foreign country participant priorities, are constantly updated and publicized through personal contacts and written communications. Consequently, the bulk of the proposals currently submitted for consideration are generally of the highest interest to U.S. agriculture.

Selected Examples of Recent Progress: Through September 30, 1976, a total of 1,705 research agreements have been obligated with foreign research institutions. In fiscal year 1976, 64 new agreements were obligated. Agreements vary in total amount for the life of the project from approximately $12,000 to slightly over $475,000 dollar equivalent. Recent examples of research progress under these agreements follow:

1. New Techniques Found for Producing Virus-Free Citrus Seedlings. One of the research frontiers in plant science is producing new plants from old through tissue culture techniques. Research in India has produced virus-free citrus plants from infected stocks and is accelerating multiplication of virus-free rootstocks for citrus orchards.

2. Nutritious Low-Cost Meals Developed for Young Children. Studies in India demonstrated ways of supplementing cereals to supply sufficient protein and other nutrients or maintaining adequate nutrition without adding large amounts of animal products. The diets formulated in these studies could be modified using foods available in the United States or in any other country to provide adequate nutrition at low cost.

3. Yugoslavia Blackberries have Potential for U.S. Research in Yugoslavia identified four blackberry lines with outstanding hardiness and resistance to pests and diseases. Another line was found to be outstanding in producing multiple berry clusters. Use of the native Yugoslavian blackberry material has been initiated in the U.S. to develop the type of coldhardiness required for the mid-Atlantic States.

4. New Techniques Developed for Crop Improvement. Scientists in Israel working with peanuts developed techniques for detecting natural-occuring differences in the non-chromosomal inheritance of plant cells. They also discovered several new methods for producing these unique mutations. This project has generated some 51 cross-combinations that are now being used to improve domestic peanuts and the techniques are being applied in breeding improved corn and pearl millet.

5. Biological Control Found for Tea Scale Insect. The tea scale is a serious pest of ornamental plants in the South, and of mango orchards in Florida. A small wasp which parasitizes this scale insect was imported into Florida from India. Information after the first release of the parasite in the Gainesville, Florida, area have confirmed its potential as an effective method for control of the scale insect.

6. New Control Developed for Khapra Beetle. The khapra beetle is a major destroyer of stored grains and food products in many countries. Research in Pakistan has established several methods that improve the effectiveness of eight insecticides and combinations of insecticides for controlling khapra beetle. Results from this project help lessen the hazards of costly reinfestations of stored grain in the U.S.

7. Polish Researchers Demonstrate Efficiency of Ultra Low-Volume (ULV) Spray Systems to Protect Apple Trees. With the (ULV) system, apple trees are protected using half as much pesticide. With low volume requirements, the likelihood of environmental hazards are reduced. The use of lighter equipment causes less soil compaction. Also hazards for the operators are reduced since mixing and washing stations at the orchards are eliminated.

Special Foreign Currency Program
Research Proposals and Agreements by Subject Matter
(Cumulative: Through September 30, 1976)

	Number of Proposals				Total Number of Agreements Obligated		Total Number of Agreements Currently Active	
	Received	Rejected	Awaiting Modification Negotiation or Review	Approved (Proposals) Awaiting Obligation	Number	Dollar Equivalent	Number	Dollar Equivalent
Agricultural Research Service	3,958	2,310	57	160	1,431	$ 95,267,938	324	$28,906,667
Forestry Research	499	250	6	17	226	14,926,311	53	5,162,802
Agricultural Economics Research	163	108	7	4	44	2,460,664	9	947,220
Statistical Reporting Service	3	2	-	-	1	32,073	-	- 1,467
Animal & Plant Health Ins. Service	1	-	-	-	1	136,806	1	136,806
TOTALS	4,624	2,670	70	181	1,703	$112,823,792	387	$35,152,028

Obligations, Expenditures and Conversions of Foreign Currencies

Obligations: Through September 30, 1976, a total of $120,287,021 (including $5,068,131 for administrative expenses) has been obligated for activities under the Special Foreign Currency Program. In fiscal year 1977, an additional $8,904,632 will be used. These obligations are summarized as follows:

Cumulative Obligations through F.Y. 1977
(Dollars in Thousands)

Fiscal Year	Market Development Research (Sec. 104(b)(1))	Agricultural and Forestry Research (Sec. 104(b)(3))	Translations of Publications and Scientific Cooperation, Executive Office of the President a/	Total
1958	$ 371.5	$ --	$ --	$ 371.5
1959	1,651.8	--	1.7	1,653.5
1960	2,230.5	--	793.2	3,023.7
1961	1,893.2	1,832.4	1,565.2	5,290.8
1962	2,859.0	5,294.6	595.8	8,749.4
1963	2,566.3	5,000.7	248.6	7,815.6
1964	3,214.8	4,466.4	555.5	8,236.7
1965	3,485.8	5,408.1	72.2	8,966.1
1966	703.7	3,877.4	-199.5	4,381.6
1967	1,620.6	7,953.2	114.5	9,688.3
1968	991.9	6,317.0	- 44.1	7,264.8
1969	971.9	4,733.2	--	5,705.1
1970	790.5	4,076.0	--	4,866.5
1971	654.0	4,171.8	--	4,825.8
1972	840.4	5,853.6	--	6,694.0
1973	1,026.1	7,995.8	--	9,021.9
1974	195.9	7,551.5	--	7,747.4
1975	349.2	6,263.6	--	6,612.8
1976 b/	326.6	9,044.7	--	9,371.3
1977 (Est'd.)	1,000.0	7,904.6	--	8,904.6
Total	$27,743.7	$97,744.6	$3,703.1	$129,191.4

a/ This fund merged with Special Foreign Currency Program by the Department of Agriculture and Related Agencies Appropriation Act, 1969. b/ Includes Transitional Quarter.

The following tables present a more detailed picture of the $9,371.3 obligated in 1976 and the $8,904.6 estimated to be obligated in 1977 for the Special Foreign Currency Program.

Special Foreign Currency Program, July 1, 1975 - September 30, 1976 Obligations
(In Thousands)

Country	Market Development Research Section 104(b)(1) Agricultural Research	Agricultural and Forestry Research Section 104(b)(3) Agricultural Research	Agricultural Economics Research	Forestry Research	Animal and Plant Health Inspection Service	Total
Burma	$ - -	$ .1	$ - -	$ - -	$ - -	$ .1
Colombia	- -	- -	- -	- .1	- -	- .1
Egypt	110.2	2,940.6	- -	166.0	- -	3,216.8
Germany	3.5	- -	- -	- -	- -	3.5
Guinea	- -	.2	- -	- -	- -	.2
India	- 13.1	151.2	- -	- -	- -	138.1
Israel	- 6.2	- 28.5	- 1.6	- 2.3	- -	- 38.6
Italy	34.2	- .3	- -	- .2	- -	33.7
Morocco	- -	- 16.4	- -	- -	- -	- 16.4
Pakistan	- 1.5	2,627.6	6.8	166.2	137.2	2,936.3
Poland	215.5	1,518.9	- -	588.8	- -	2,323.2
Sri Lanka	- -	- 13.8	- 2.3	- 2.3	- -	- 18.4
Tunisia	- -	9.8	- -	- -	- -	9.8
Turkey	- -	- .2	- -	- -	- -	- .2
United Kingdom	- 2.0	- -	- -	- -	- -	- 2.0
Yugoslavia	- 14.0	- 41.0	- .6	- 9.1	- -	- 64.7
Total	$ 326.6	$7,148.2	$ 2.3	$ 907.0	$137.2	$8,521.3
Transfer to National Science Foundation for translation of scientific publications						850.0
GRAND TOTAL						$9,371.3

Special Foreign Currency Program, Estimated FY 1977 Obligations
(In Thousands)

Country	Market Development Research Section 104(b)(1)	Agricultural and Forestry Research Section 104(b)(3)			
	Agricultural Research	Agricultural Research	Agricultural Economics Research	Forestry Research	Total
Egypt	$ 515.0	$1,962.9	$301.0	$ - -	$2,778.9
India	200.0	960.0	- -	215.0	1,375.0
Italy	25.0	15.0	- -	- -	40.0
Pakistan	260.0	1,935.0	- -	65.0	2,260.0
Poland	- -	934.0	- -	166.0	1,100.0
Tunisia	- -	149.0	- -	- -	149.0
Total	$1,000.0	$5,955.9	$301.0	$446.0	$7,702.9
Transfer to National Science Foundation for translation to scientific publications					1,201.7
GRAND TOTAL					$8,904.6

Expenditures: Expenditures of foreign currencies, from the inception of the program through September 30, 1976, totaled $101,093,015. In addition, the Department plans to expend $9,067,000 in fiscal year 1977. These expenditures may be summarized as follows:

Cumulative Expenditures through F.Y. 1977
(In Thousands)

Fiscal Year	Market Development Research	Agricultural and Forestry Research	Translation of Publications and Scientific Cooperation Executive Office of the President a/	Total
1959	$ 195.1	$ - -	$ 0.1	$ 195.2
1960	654.6	- -	75.1	729.7
1961	1,254.9	350.2	495.2	2,100.3
1962	1,735.8	1,351.8	425.6	3,513.2
1963	2,136.8	2,071.7	590.9	4,799.4
1964	2,292.9	2,514.9	655.5	5,463.3
1965	2,816.3	3,724.6	616.0	7,156.9
1966	2,435.2	4,113.9	211.2	6,760.3
1967	2,487.0	4,754.6	224.7	7,466.3
1968	1,951.0	5,028.8	200.5	7,180.3
1969	1,598.9	5,454.6	- -	7,053.5
1970	1,092.6	4,863.4	- -	5,956.0
1971	955.9	4,753.1	- -	5,709.0
1972	884.2	5,337.3	- -	6,221.5
1973	704.1	4,644.0	- -	5,348.1
1974	731.2	7,052.9	- -	7,784.1
1975	783.6	6,491.7	- -	7,275.3
1976 b/	902.9	9,477.8	- -	10,380.7
1977 (est'd.)	901.8	8,165.2	- -	9,067.0
Total	$26,514.8	$80,150.5	$3,494.8	$110,160.1

Cumulative Expenditures through F.Y. 1977
(In Thousands)

Conversions: As of September 30, 1976, the Department had converted a total of $4,833,448 of foreign currencies as follows:

Fiscal Year	(Dollars in Thousands)
1961	$ 770.0
1962	1,432.0
1963	1,910.1
1964	721.3
Total	$ 4,833.4

a/ This fund merged with Special Foreign Currency Program by the Department of Agriculture and Related Agencies Appropriation Act, 1969, are included in the preceeding table.

b/ Includes Transitional Quarter.

Passenger Motor Vehicles

The 1978 Budget Estimate does not include any purchase of additional passenger motor vehicles. A total of 94 vehicles will be replaced.

Replacements

Replacements would be made of 94 of the 472 (including 8 buses) passenger motor vehicles operated at field stations engaged in research. These vehicles are used in travel where no public transportation is available, such as to farms, ranches, cooperating experiment stations, etc., and in travel to remote sections of large stations. They are essential for collecting experimental data and materials necessary for facilitating research work.

It is estimated that all of the 94 passenger vehicles to be replaced will have mileage of more than 60,000 or be 7 or more years old.

Age and Mileage Data for passenger-carrying vehicles on hand as of June 30, 1976:

Age-Year Model	Number of Vehicles */	Percent of Total	Lifetime Mileage (thousands)	Number of Vehicles */	Percent of Total
1971	238	52	80-100	8	2
1972	23	5	60-80	57	12
1973	89	19	40-60	148	32
1974	64	14	20-40	152	33
1975	27	6	Under 20	95	21
1976	19	4			
TOTAL	460	100		460	100

*/ Excludes 5 vehicles used in foreign countries, and 8 buses.

Aircraft

Replacements

The one replacement plane would be one designed specifically for agricultural work and would be used by technicians in investigating and demonstrating the use of special equipment for suppression of destructive insects attacking crops. Replacements will be made by purchase or from surplus sources. Planes rapidly become obsolete and uneconomical to repair and are subject to many mishaps. Replacement will not be made, however, if it is found pratical and economically feasible to retain the present equipment.

Additions

Objective: To obtain one additional aircraft from Animal and Plant Health Inspection Service (APHIS) without cost to be located at College Station, Texas, to conduct research on experimental spray equipment and aerial application of dry pesticides, seeds and dry fertilizers.

Need for Increase: Research is necessary for applying dry pesticides, seeds and dry fertilizers as well as developmental research for more efficient spray-type equipment for pratical usage. Current aerial application is often unreliable and uneven distribution of materials occur. Due to spray drift and uneven distribution of materials, average efficiency of application is about 25 percent. Aerial application of dry materials will improve efficiency and reduce atmospheric pollution. These methods can provide a 50 percent savings in pesticides for insect and weed control and result in a 200 percent increase in acreage treated annually for control of weeds and brushes by 1985.

Plan of Work: The Piper Pawnee agricultural aircraft is excess to the needs of APHIS and is available for transfer to ARS at no cost. ARS is presently using the aircraft on a loan basis for research on equipment for aerial application of dry pest control materials, seeds and dry fertilizers.

Initial research will concern engineering development of equipment to uniformly distribute dry materials such as granules, pellets, and seeds. A system for producing electrostatically-charged uniform droplet sprays will also be developed for the aircraft. Ensuing work will include field evaluation by a multi-disciplinary team of engineers and biological scientists. Effectiveness of various application methods and materials, as affected by physiological, soil, atmosphere and other parameters, will be studied for specific pest control problems. This work will be coordinated with aerial application research at Yakima, Washington, rangeland forage research at Temple, Texas, and other pest control research at College Station, Texas.